SAMSUNG

NX-keyset

(NX-24, NX-12, NX-6, NX-AOM)

SERVICE Manual

DISPLAY NX-keyset

CONTENTS

1. GENERAL DESCRIPTION
2. CIRCUIT DESCRIPTION
3. TROUBLE SHOOTING
4. PBA LAYOUT & PARTS LIST
5. EXPLODED VIEW & PARTS LIST
6. CIRCUIT DIAGRAM

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1. GENERAL DESCRIPTION

1.1 THE TYPES OF KEYSETS.....1
1.2 SPECIFICATIONS.....1
1.2.1 DIMENSIONS AND WEIGHTS.....1
1.2.2 ENVIRONMENTAL LIMITATIONS.....1
1.2.3 CABLE REQUIREMENTS.....2
1.3 PRECAUTIONS.....2

1. GENERAL DESCRIPTION

1.1 THE TYPES OF KEYSETS

- Keyset with 24 buttons (**NX-24E**, **NX-24B**)
  Built-in speakerphone
  24 programmable soft keys (12 with tri-colored LEDs)
  10 fixed function keys
  UP/DOWN buttons for digital control of speaker, handset and ringer volumes.
  Four selective ring tones per keyset
  Desk-mounted or wall-mounted
  NX-24E keyset : with 16 character display

- Keyset with 12 buttons (NX-12E, NX-12B)
  Built-in speakerphone
  12 programmable soft keys (6 with tri-colored LEDs)
  10 fixed function keys
  UP/DOWN buttons for digital control of speaker, handset and ringer volumes.
  Four selective ring tones per keyset
  Desk-mounted or wall-mounted
  NX-12E keyset : with 16 character display

- Basic keyset with 6 buttons (NX-6B)
  6 programmable soft keys
  10 fixed function keys
  UP/DOWN buttons for digital control of speaker, handset and ringer volumes.
  Four selective ring tones per keyset
  Desk-mounted or wall-mounted

- Add On Module (NX-AOM)
  24 programmable soft keys

1.2 SPECIFICATIONS

1.2.1 DIMENSIONS AND WEIGHTS

KEYSET	214 mm(H) × 206 mm(W) × 150 mm(D), 1.1 Kg
AOM	214 mm(H) × 133 mm(W) × 150 mm(D), 0.4 Kg

1.2.2 ENVIRONMENTAL LIMITATIONS

OPERATING TEMPERATURES	0 ℃ - 45 ℃ (18 ℃ - 25 ℃ recommended)
OPERATING HUMIDITY	10 % - 90 % (without condensation)

1.2.3 CABLE REQUIREMENTS

To install the KTS(Key Telephone Set) 2 pair twisted 24 AWG is required. To increase the quality of call processing, the maximum length of the line is required under 400m.

1.3 PRECAUTIONS

- Do not use or store in areas of high levels or dirt, dust, or corrosive gas. These places will shorten your unit'suseful life.
- Keep your unit away from hot areas. High temperature can shorten the life of electronic devices, damage batteries, and can even distort or melt certain plastics.
- Keep it dry. If water should get on it, wipe it off immediately. Water contains minerals that can corrode electronic circuits.
- Do not drop your product. This will likely result in failure to operate. Circuit boards can crack and cases may not survive the impact. Handling yourproduct roughly will shorten its useful life.
- Do not use harsh chemicals, cleaning solvents or strong detergents to keep your unit looking new. You need only wipe it with a dampened cloth from time to time.
- To reduce the risk of electric shock, do not remove the cover of the unit. No serviceable parts inside. Refer servicing to qualified service personnel.

2. CIRCUIT DESCRIPTION

● KEYSET OVERVIEW.....1
2.1 CPU & PERIPHERALS.....1
2.2 DATA COMMUNICATION CIRCUIT.....4
2.3 KEY SCANNING CIRCUIT.....5
2.4 LED DRIVING CIRCUIT.....7
2.5 LCD INTERFACE MODULE.....9
2.6 HANDSET HOOK ON/OFF DETECTOR.....9
2.7 KEY CONFIRMATION TONE GENERATOR.....10
2.8 RING TONE GENERATOR with VOLUME CONTROL.....10
2.9 SPEECH HYBRID CIRCUIT.....11
2.10 NETWORK.....12
2.11 HANDSET INTERFACE CIRCUIT.....12
2.12 SPEAKER-PHONE CIRCUIT.....14
2.13 SPEAKER DRIVER WITH VOLUME CONTROL.....15
2.14 POWER REGULATOR.....16

2. KEYSET CIRCUIT DESCRIPTION

This section includes the detail descriptions of the keyset circuit and operations. Proceed with the related circuit diagram and block diagrams.
Keysets "**NX**" Series is composed of many circuits, that is, CPU and its peripherals, data communication circuit, key scanning circuit, LED driving circuit, LCD Module part, Handset hook ON/OFF detector, Ring-Tone generator, key confirmation tone generator, speech hybrid circuit, network, handset interface, circuit with digital volume control, speaker-phone circuit, speaker driving circuit with digital volume control, and power regulators.

● KEYSET OVERVIEW

"NX" series Keyset is a analog subset which operates behind "NX" system made by SAMSUNG Electronics Co. LTD. NX series include for of keysets.

NX12-S24WL : LCD display added to the standard features on 24 Line.
NX12-S24 : standard keyset on 24 Line.
NX12-S12WL : LCD display added to the standard features on 12 Line.
NX12-S12 : standard keyset on 12 Line.
NX12-S6 : simple keyset.
NX12-SDSS : Add On Module.

NX Series are controlled by the included CPU; Intel or Dae-Woo 80C51; and the operations are directed by the data from KSU; NX-1232, NX-820 and NX-308 systems.
The related main system is NX Series System but this model can operate well connected to the other systems; SKP-308H, SKP-816H, SKP-36HX, and SKP-56/120H.
For installing to the SKP-56/120H system, the special board (MSLC2) is required.

There are many buttons for one-touch feature accomplishment; 24 DTS/DSS buttons, 12 dial buttons and 12 feature buttons. SPEED, TRANSFER, REDIAL, FLASH, CALLBACK, PAGE, MUTE, MESSAGE, SPEAKER, HOLD, VOLUME (+), VOLUME (-) buttons are all the feature buttons.
NX Series provide the Audible and Visual services with the various tones and ring-tone and LEDs and LCD.
24 DTS/DSS buttons and 4 feature buttons (MUTE, MESSAGE, SPEAKER, HOLD) are equipped with RED or RED/GREEN LED.
The first 12 DTS/DSS buttons include the dual LEDs; Green LED indicates the outside line is used by the user and Red LED says the line is used by the other subscriber.
NX Series is largely composed of Main Set, Handset, Line cord, Handset cord, and Wall-Mount/ Desk Bracket based on the structure.

2.1 CPU & PERIPHERALS

Intel or DaeWoo 8051 is used as CPU of which major features are as follows;

8-bit CPU
On-chip Oscillator
4K bytes of Program Memory
128 bytes of Data Memory
21 Special Function Registers
32 I/O lines

64K address space for external Data Memory
64K address space for external Program Memory
Two 16-bit Timer/Counters
A five-source interrupt structure with two priority levels
A full duplex serial port
Bit addressability for Boolean processing

For this product, any external memory is not used. The detail features may be referred from Intel or DaeWoo data book but it must not be necessary to support the keyset.

The **system clock** is provided with **11.059MHz crystal**, and its machine cycle is 1.085 micro-second for one machine cycle requires 12 system clocks. For good oscillation with little distortion, the crystal by-pass capacitors are determined to 20 pico-farad in their capacitances.

To prevent from radiating EMI [Electro-Magnetic Interference], the 5-volt power is fed to CPU in series with EMI filter, CFI 103M which is internally composed of two small-inductance ferrite beads and 10 nano-farad capacitor. The filter blocks CPU noise from transmission, which reduces the radiation of the noise.

To protect CPU from electrical shock or trap, a reset circuitry may be required, which should be composed of the level detector and the watch-dog circuit.

A **level detector** may monitor the power variation of CPU and resets and protects CPU and the internal memory if the power is detected out of range.
The level detector equipped in NX series is composed of a capacitor, two signal diodes and some passive components. The reference voltage is provided with two diodes (D1, D2) by their forward voltage drops. The devices determine the threshold voltage about 4.0 volt and the reset signal, high state over 3.0 volt activates CPU restart if 5 volt power varies under the threshold voltage. Otherwise, the comparator output sustains Low.
The threshold voltage is determined as following equations;

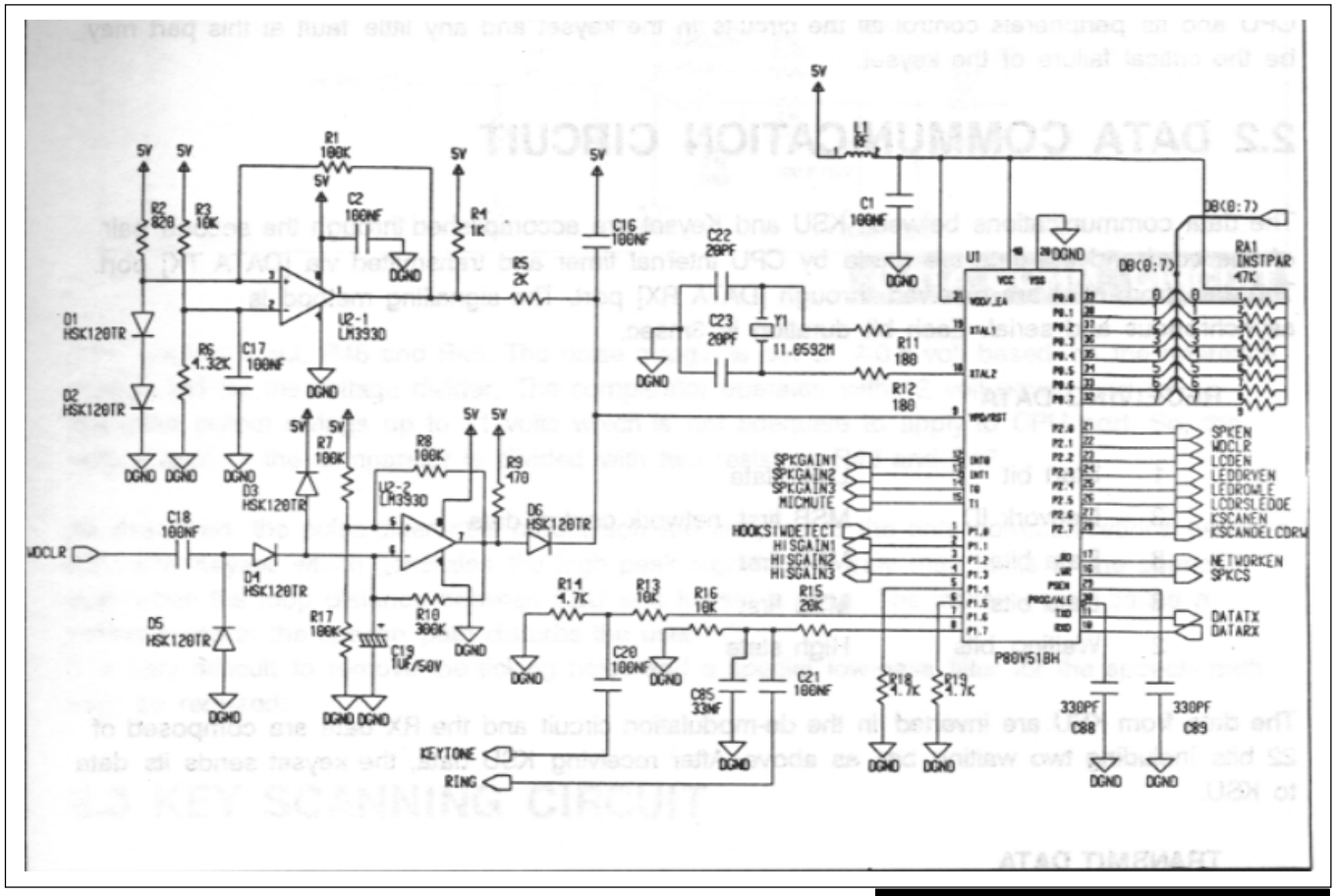
$$Threshold\ Voltage = ((R3 + R6) / R6) \times Vref$$

Intel 8051 has high-active reset structure and the level detector is designed to generate High signal during the abnormal power supply.
The level detector is activated to reset CPU when the power ON/OFF or any power variation during operation.

A **Watch-dog Circuit** monitors CPU operation and generates the reset signal when it detects the mis-operation of CPU. The detection can be accomplished with the watch-dog clear signal. During operation, CPU provides the periodic clear signal to the watch-dog circuit but the signal will be stuck to low or high state when the program drops to a trap or CPU perceives a mis-operation, for example, the absence of the data from the system.
The watch-dog circuit is composed of a comparator (U28), five switching diodes, and some passive devices. The circuit is a pulse generator, regardless of the input signal of the clear signal. Let's see the operation of the pulse generator.
The comparator has two feedback path; the positive and negative feedback. The positive feedback enhances the operation of the comparator and it provides the difference between the high threshold reference and the low threshold reference which are the levels of the non-inverting terminal. The negative feedback is a charging and discharging path to the capacitor, C 19.

The output of the level detector and the watch-dog circuit are simply connected to produce the OR logics. Any high state of them should be transferred to the reset terminal of CPU for it has the high-active reset interfaces. So, OR logic is necessary to combine two outputs.

The pull-up resistors results from the open-collector outputs of the comparator and one serial resistor and one blocking diode make the OR logic. Owing to the interface, the high output of the level detector will be fully transferred to CPU reset terminal and the high output of the watch-dog circuit will be converted to 3.5V of which level is enough to reset CPU.



CPU & PERIPHERALS

The next part is about **Reset Operation**. When the keyset is connected to working KSU, the power is fed to keyset. Then the logic power, 5 volt will rise and the level detector will generate a short power-on-reset pulse according to the power rising time. In addition to this, the watch-dog circuit generate 329msec high pulse to reset CPU. The power-on-reset signal protects CPU from the power transition and guarantees the initial time for the peripheral devices, especially crystal, which stabilizes all the operation of the peripheral devices before CPU runs.
After power-on-reset time, CPU starts to run and it checks buttons. It detects whether any one of buttons is stuck or not. It is very important because all the buttons are the tools for the man -machine communications and key-sticking disturbs the right detection of key-pressing (button pressing).

If CPU perceives a key-sticking during checking buttons, CPU stops generating the watch-dog

clear signal and drives the HOLD LED to be flickered. Stopping the watch-dog clear signal causes the reset signal to CPU as described, and the previous initiating procedure repeats. After checking the buttons, CPU starts to receive and transmit its data to KSU and it requests to be registered in the system. But, CPU may causes the reset and drives SPK LED emitted if it cannot receive any data from KSU. Any data absence may cause the reset with SPK LED emmision.

In addition to these, the watch-dog circuit may perceive any program-sticking and the level detector perceive any power variation and it generates the reset signal at that case.

CPU and its peripherals control all the circuits in the keyset and any little fault at this part may be the critical failure of the keyset.

2.2 DATA COMMUNICATION CIRCUIT

The data communications between KSU and Keyset are accomplished through the second pair of line cord and the data are made by CPU internal timer and transmitted via [DATA TX] port. The data from KSU are received through [DATA RX] port. The signalling method is asynchronous and serial. Each bit duration is 3msec.

RECEIVING DATA

1	Start bit	Low state
3	Network ID	MSB first, network control data
8	Data bits	MSB first
8	Data bits	MSB first
2	Waiting bits	High state

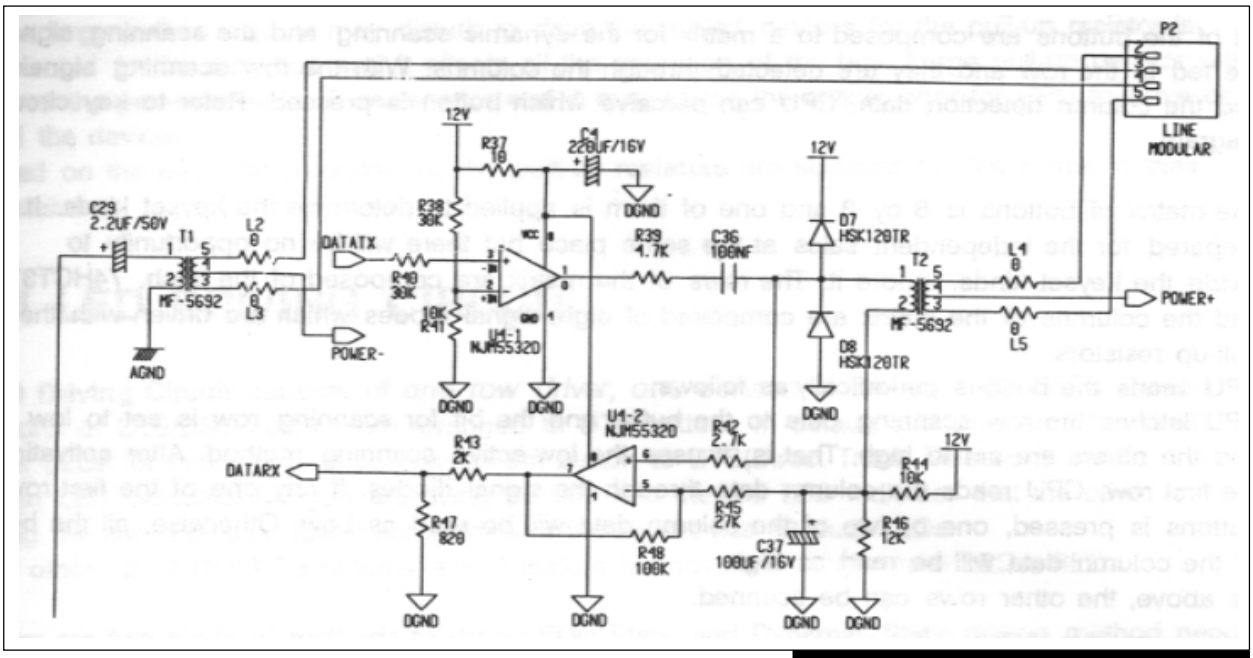
The data from KSU are inverted in the de-modulation circuit and the RX data are composed of 22 bits including two waiting bits as above. After receiving KSU data, the keyset sends its data to KSU.

TRANSMIT DATA

1	Start bit	High state
1	Parity bit	Even parity check
7	Data bits	MSB first
2	Waiting bits	Low state

Totally, one data monitoring between KSU and Keyset requires 33 bits, that is 99msec.

The data transmitted are amplified with the data TX OP-AMP and modulated to the pulse-differential signals through the resistor (4.7K ohm) and the capacitor(100 nF). The time constant is determined to 0.47msec based on the values of the capacitor and resistor owing to the bit duration of 3msec. And, the received data are the differential-modulated signals and they are recovered/de-modulated with the comparator. The comparator circuit is a inverting latched flipflop and its noise margin is determined by the value of the passive devices attached to the non-inverting input, R48 and R45. The noise margin is set to $\pm$0.8 volt based on the reference



DATA COMM. CIRCUIT

voltage fed by the voltage divider. The comparator operates with 12 volt power and its saturated output swings up to 11 volts which is not adequate to apply to CPU port. So, the output level of the comparator is divided with two resistors, R43 and R47.

As described, the pulse-differential modulation are adopted to the data communications between KSU and Keyset, which generates the high peak signals and they may leaks to the speech path when the loop distance between KSU and keyset is long. The leakage may cause a ticking noise at the speech path disturbs the user.
It is very difficult to remove the ticking noise and a special low-pass filter for the speech path may be required.

2.3 KEY SCANNING CIRCUIT

There are so many buttons in the keyset; 24 DTS/DSS buttons, 12 dial buttons and 12 feature buttons totally 48 buttons. All of these buttons should be monitored by CPU whether a button is pressed or not.

Generally, there are two kinds of key-scanning method; static scanning and dynamic scanning. The static scanning required the individual detector and the application circuit is very simple. It does not generate any noise but if requires the same number of detectors.

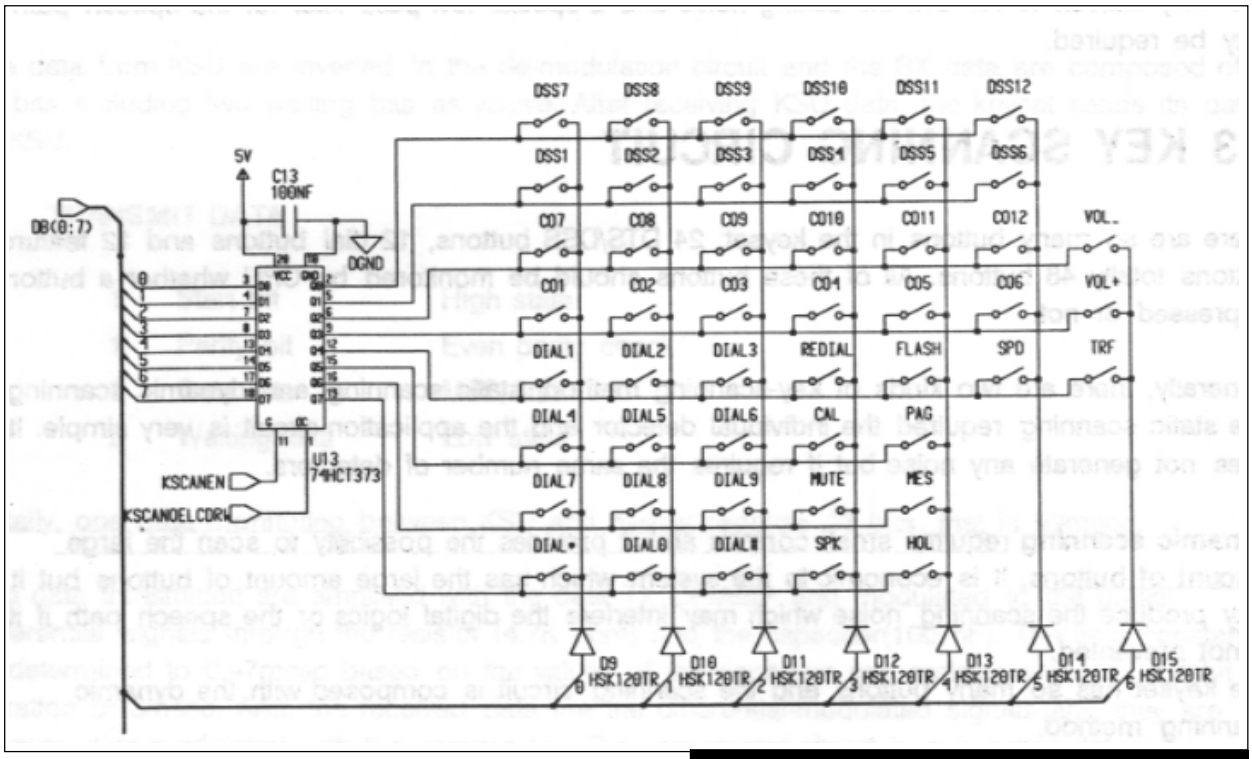
Dynamic scanning requires small controls and it provides the possibility to scan the large amount of buttons. It is economic to the system which has the large amount of buttons but it may produce the scanning noise which may interfere the digital logics or the speech path if it is not prevented.
The keyset has so many buttons and the scanning circuit is composed with the dynamic scanning method.

All of the buttons are composed to a matrix for the dynamic scanning and the scanning signals

are fed to the row and they are detected through the columns. With the row scanning signals and the column detection data, CPU can perceive which button is pressed. Refer to key circuit diagram.

The matrix of buttons is 8 by 8 and one of them is applied to determine the keyset kinds. It is prepared for the independent sales at the same place but there will be no opportunity to divide the keyset kinds. Ignore it. The rows of the matrix are composed of the latch, 74HCT373, and the columns of the matrix are composed of eight signal diodes which are driven with the pull-up resistors.
CPU scans the buttons periodically as follows;
CPU latches the row scanning data to the buffer and the bit for scanning row is set to low and the others are set to high. That is, it uses the low-active scanning method. After activating the first row, CPU reads the column data through the signal diodes. If any one of the first row buttons is pressed, one or two of the column data will be read as Low. Otherwise, all the bits of the column data will be read as high.
As above, the other rows can be scanned.

The button contacts are made of carbon and each contact has some hundred ohm resistance based on the procedure of PCB manufacture. And the detection level of CPU bus is **0.8V at maximum**. To meet the detection condition, the reading path is composed of the carbon contact, diode, and pull-up resistor. Here, the pull-up resistor effects largely. The pull-up resistor determines the current through the path and the forward voltage drop of the diode can be determined based on the current. And the voltage drop on the carbon contact is also determined based on the current. The voltage drops will reduce as the current reduces and the voltage drops will increase as the current increases. Therefore, to stabilize the detecting operation, reducing the current is essential. To reduce the current, the resistance of pull-up resistor should be selected to the large value.
But a large pull-up resistor may disturb to drive the related devices for the pull-up resistor is



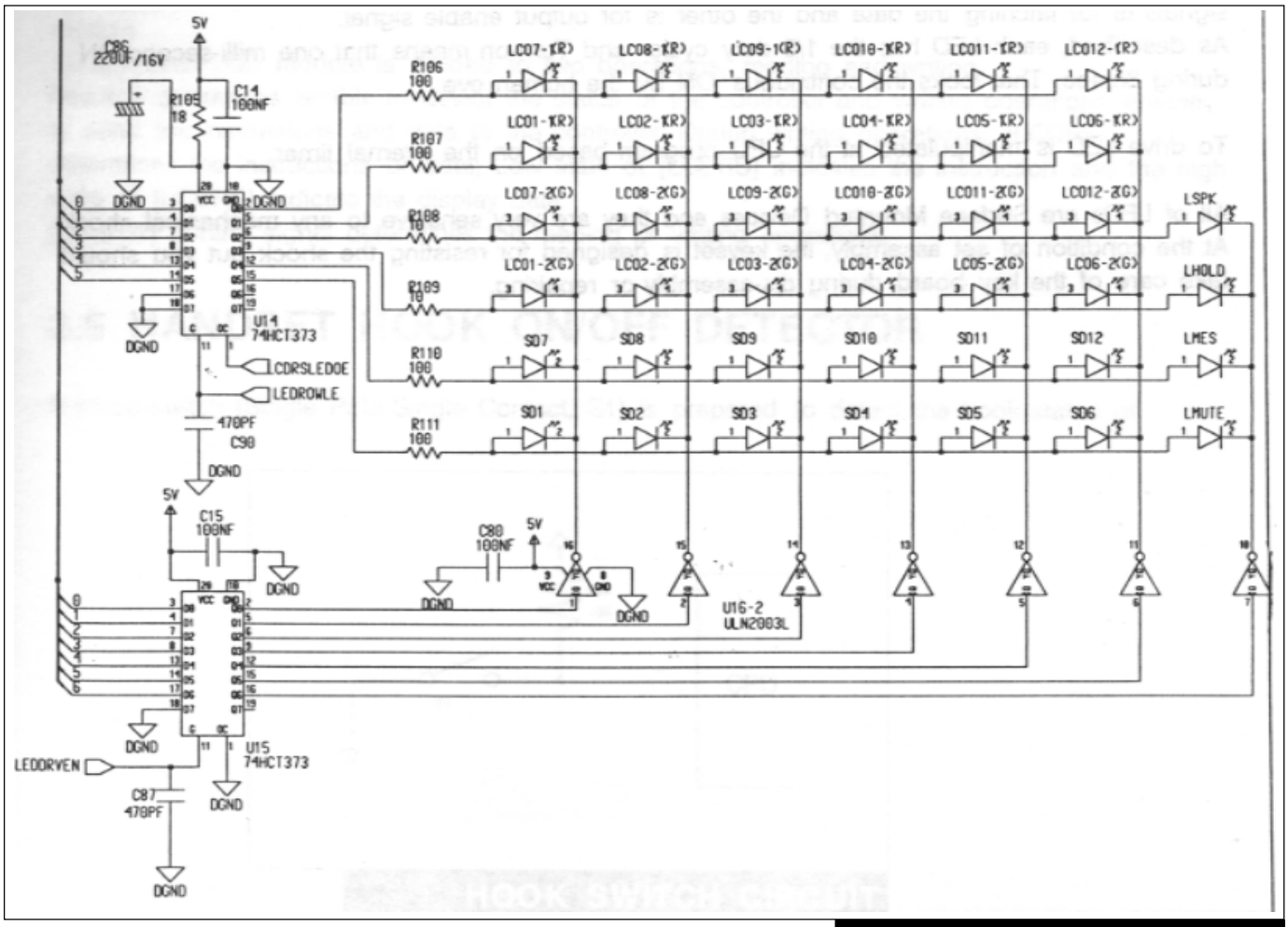
KEY SCANNING CIRCUIT

connected to the data bus and it effects all the operation of the bus. Large pull-up resistor will reduce the pan-out/pan-in characteristics and it may cause the critical error for CPU to drive or read the devices.
Based on the above two conditions, the **pull-up resistors** are selected to **47K ohms** in their resistances.

2.4 LED DRIVING CIRCUIT

LED Driving Circuit consists of *one row driver, one column driver, and 40 LEDs*. Twelve buttons of DTS/DSS buttons are arranged to DTS buttons in default and they have the dual color LEDs for indications. If you assign the button to DTS(Direct Trunk Selection) button, the green LED indicates that you are using the line and the red LED indicates that the other is using the line. For this dual color indication, the keyset has 12 dual LEDs.
The other 12 of DTS/DSS buttons and 4 feature buttons have single color LEDs; RED.

There are two kinds of methods to drive LEDs; Static and Dynamic. Static driving method needs the same number of drivers and it generates a little noise. Each driving line is simply controlle d, High and Low. But, it has a shortcoming; it requires the same number of control lines to drive LEDs and it is not adequate to drive a lot of LEDs. To drive lots of LEDs, the dynamic driving method is applied.



LED DRIVING CIRCUIT

Dynamic driving method requires a little control lines and it is simple to assign the control circuit but it requires some complicate controls and generates some noise which should be considered during design.

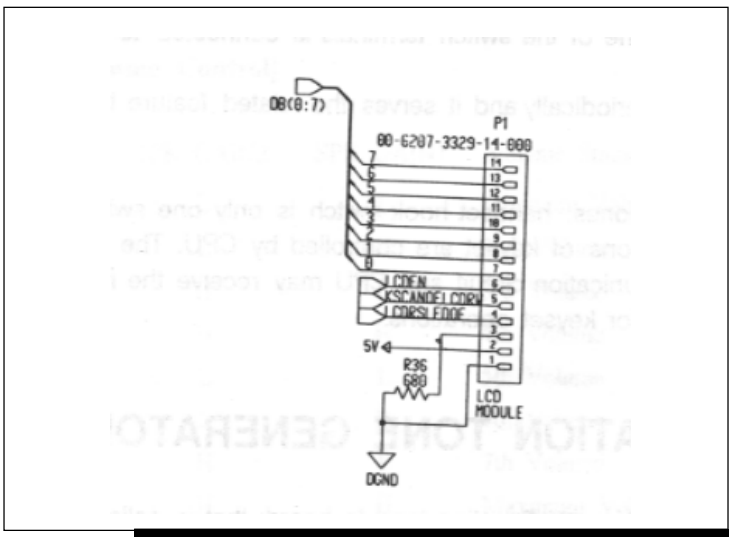
The keyset applies the dynamic driving method to drive LEDs owing to the quantity of LEDs. 74HCT373(U14) is assigned to the row driver and 74HCT373(U15) and UCN2003(U16) is assigned to the column driver. The column driver may drive eight LEDs at the same time if necessary, then a high current driver should be applied. UCN2003(U16) has the internal Darlington TR arrays and that is the reason to apply the chip to the column driver.

All of LEDs are composed of matrix, eight rows and seven columns and driving LEDs are mainly up to column driving.
Each column is activated at every 8msec. During the first one milli-second, the first column is activated and the other columns are disabled. During the next one milli-second, the second column is activated and the other columns are disabled. As above, each column is periodically activated at every 8msec. To activate the column, the related data bit should be set to high and the other bits should be low, and the latch enables signal of the column driver should be controlled, because the driver has the darlington TR arrays and they operate as inverters and the low state activates the related column line.
Column driving works continuously and the related row data can be driven based on the LED data from KSU. During column driving, any high signal at the row may activate the related LED ON. The row driver, 74HCT373 has two control signals and eight data interfaces. One of control signals is for latching the data and the other is for output enable signal.
As described, each LED has the 1/8 duty cycle and Turn-on means that one milli-second ON during 8msec. That looks the continuous ON by the human eye.

To drive LED is manipulated at the CPU program based on the internal timer.

All of LEDs are Surface Mounted Devices and they are very sensitive to any mechanical shock. At the condition of set assembly, the keyset is designed for resisting the shock but you should take care of the key board during dis-assembly or repairing.

2.5 LCD INTERFACE MODULE

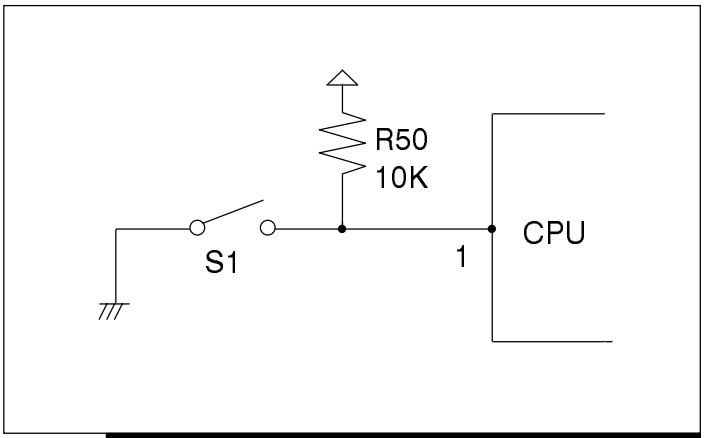


LCD MODULE INPUT CIRCUIT

One line sixteen (16) character LCD is equipped in **NX-24E** and **NX-12E** models; which is controlled by one controller and driver. The LCD controller is interfaced with CPU and the operation of controller is indicated by CPU.
LCD (Liquid Crystal Display) equipped with its controller and driver is usually called as LCD module.
To approach LCD module is divided to two operations, reading and writing.
Reading operations enable to detect the status of the controller and writing operations enable to send the instructions and data to the controller. During writing operations, [LCDRS] determines the instructions or data; Low state of [LCDRS] indicates the instruction and the high state of [LCDRS] indicate the display data.
[LCDRW] control signal determines the reading or writing operations.

2.6 HANDSET HOOK ON/OFF DETECTOR

A micro-switch (Single Pole Single Contact, S1) is prepared to detect the hook status of



HOOK SWITCH CIRCUIT

handset. When hook0on, the switch contact is open and CPU may read High status through Port2. 0 owing to the pull-up resistor, R50. When hook-off the switch contact is closed and CPU may read Low status because one of the switch terminals is connected to ground of keyset.

CPU approaches the port 2. 0 periodically and it serves the related feature based on the instructions from KSU.

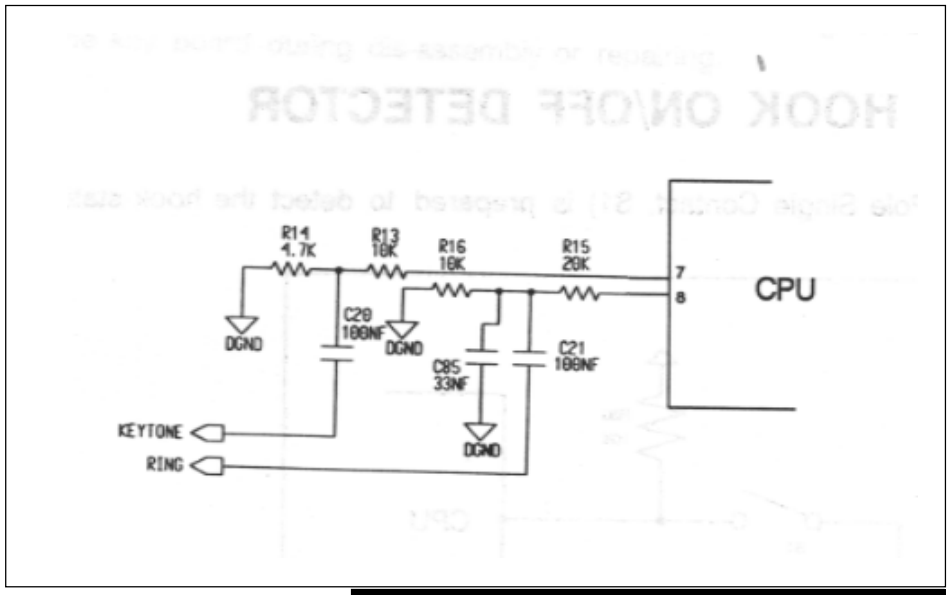
Compared with single line telephones, handset hook switch is only one switch for the status in keyset because all of the operations of keyset are controlled by CPU. The read status may be sent to KSU through data-communication circuit and CPU may receive the relating data from KSU, which are the instructions for keyset operations.

2.7 KEY CONFIRMATION TONE GENERATOR

If one of dial buttons is pressed, a confirmation tone is heard; that is called as **Key Confirmation Tone** or **Key-Tone** by and abbreviated form. CPU generates 1000 Hz single frequency signal and it bursts during 100msec immediately after a valid Dial Key is pressed. By the aid of program generation, the interface circuit is very simple; some passive components.

2.8 RING TONE GENERATOR with VOLUME CONTROL

Ring-tone signal is generated through **CPU port [RING] by program** of which On/Off is also controlled through the port. CPU can generate some mixed single frequencies [pulse train] and they are used as ring-tone signal. By the aid of program generation, four kinds of ring-tone signals are provided, which are selected by user-programming. The variety of the ring-tone is determined by the mixed rate of the different frequencies.



KEY / RING TONE CIRCUIT

The generated ring-tone signals are fed to SPEAKER VOLUME CONTROL circuit and the level is manipulated there. The volume is simply adjusted; Voltage dividing with analog switch. The

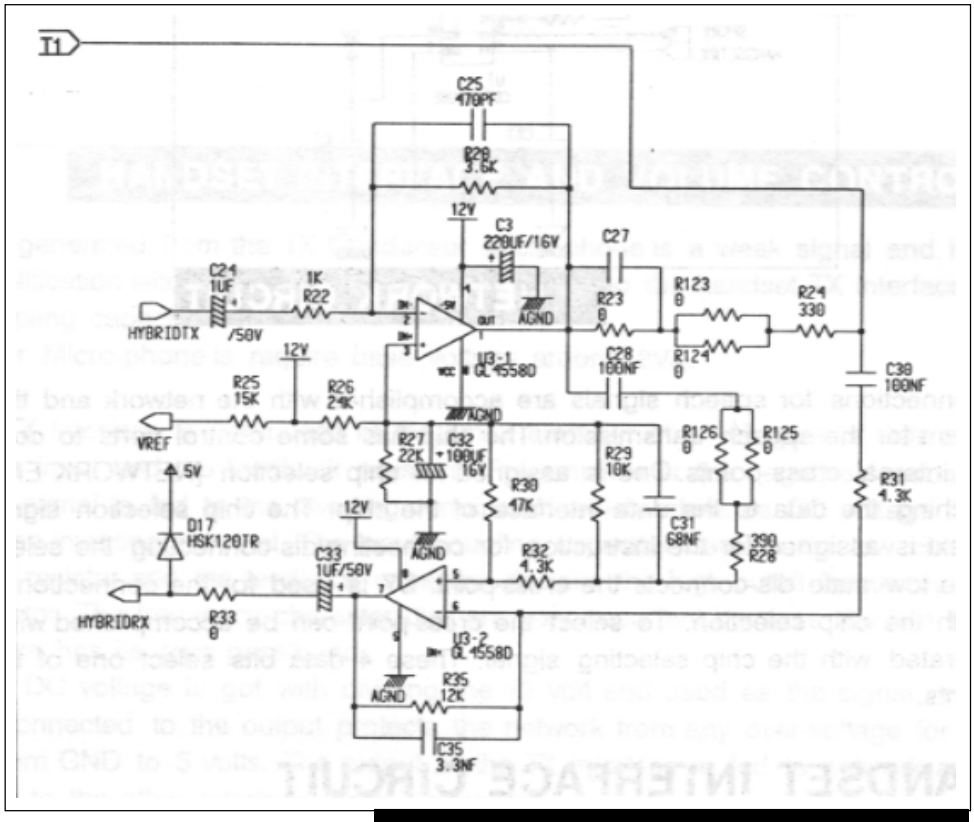
level varies 8 steps by control of analog switch of which control signals are [SPK GAIN], [SPK GAIN2], and [SPK GAIN3].

[Ring Tone Volume Control]

SPK GAIN3	SPK GAIN2	SPK GAIN1	Volume Status
L	L	L	Minimum Volume
L	L	H	2nd Volume
L	H	L	3rd Volume
L	H	H	4th Volume
H	L	L	5th Volume
H	L	H	6th Volume
H	H	L	7th Volume
H	H	H	Maximum Volume

This volume control circuit is also used for the speaker-phone RX volume control and the control signals are independently manipulated by CPU according to the status. During ringing and the specific programming, any volume up/down button may increase/decrease the value of ring buffer and the value of ring buffer is used to set the volume during ringing. For speaker-phone RX volume, the other buffer is prepared and controlled independently by CPU.
Ring-tone signals are also fed to the external speaker interface, shich is decribed later.

2.9 SPEECH HYBRID CIRCUIT



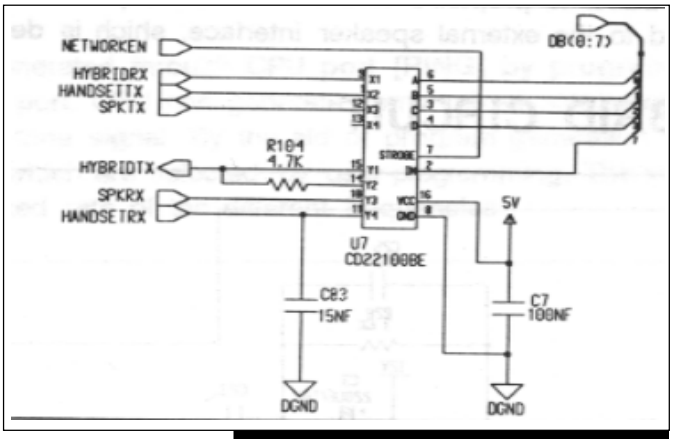
SPEECH HYBRID CIRCUIT

The keyset is equipped with the **Speech Hybrid Circuit** to accommodate mixing or dividing the speech signals to/from TX and RX. The speech signals on the system network or the line is the line is the mixed forms of TX and RX signals and they should be divided. And the speech signals in the keyset should be mixed to send. The speech hybrid circuit works the feature.

The circuit is divided to two parts; **hybrid TX amplifier and hybrid RX amplifier**. Handset TX or micro-phone signals are connected to the hybrid TX amplifier through the network. And the amplified signals are transferred to KSU via the power-isolated transformer, 5692.
The speech signals received through the transformer are fed to the hybrid RX amplifier and the output signals are connected to handset RX or speaker-phone circuit through the network. Each direction signals are restricted to voice band, from 300Hz to 3400 Hz.
To mix the transmitted and received signals generates the feedback signals which are usually called as Sidetone. The speech hybrid circuit determines the sidetone level according to the trunk loop length. The TX signals are fed to the inverting and non-inverting terminals of the RX OP-AMP to compensate and reduce the level through the related passive components.

2.10 NETWORK

The keyset is equipped with the **Network** which is **composed of four by four matrix.** CD22100 is the network chip and it has the 4 by 4 matrix cross-points.



NETWORK CIRCUIT

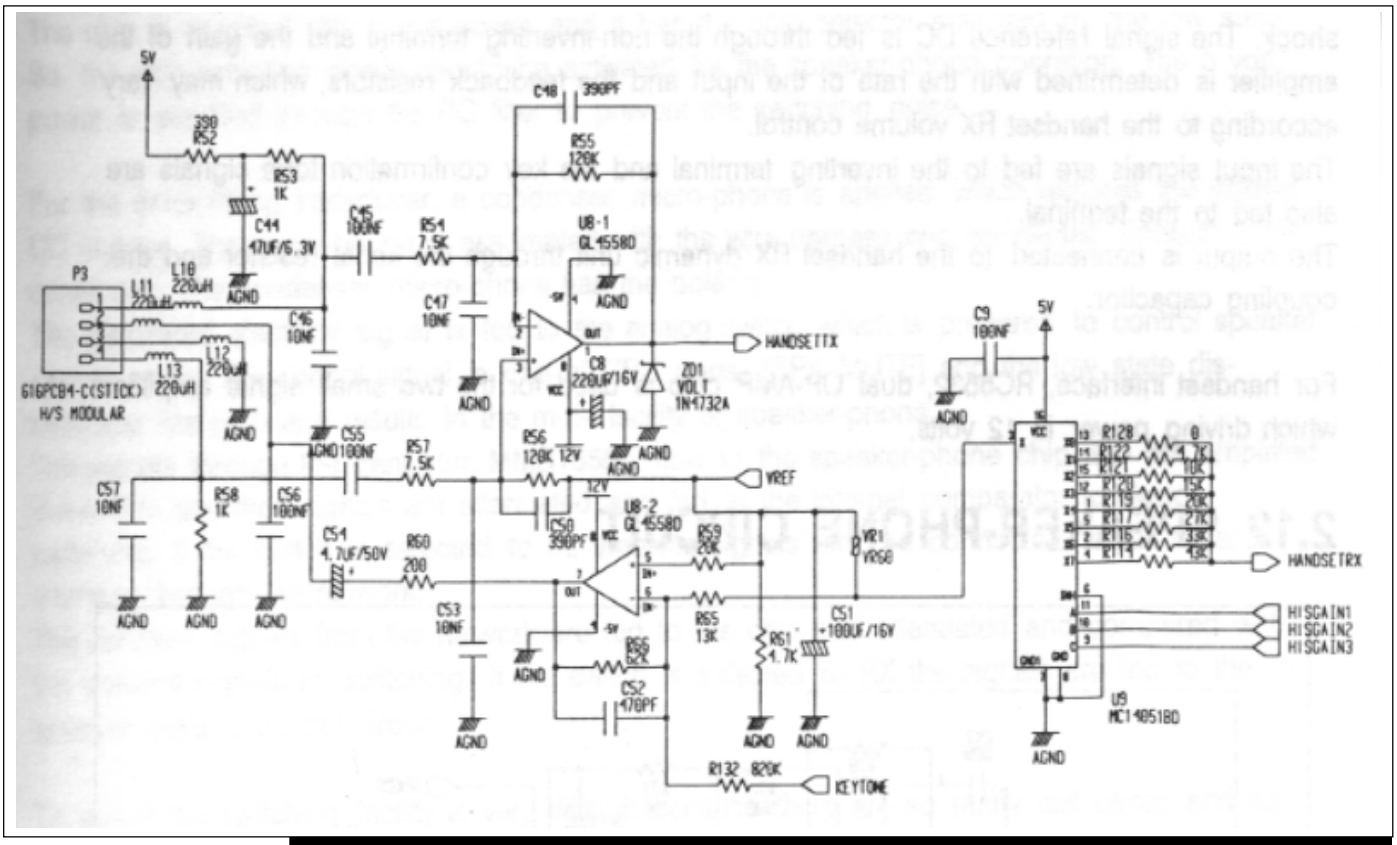
All of the connections for speech signals are accomplished with the network and the chip is the most important for the speech transmission. The chip has some control ports to connect/dis-connect the internal cross-points. One is assigned for chip selection [NETWORK EN] and it is used for latching the data to the data interface of the chip. The chip selection signal is active-High. The next is assigned for the instruction for connecting/dis-connecting the selected cross-point and the low state dis-connects the cross-point. D7 is used for the connection instruction operated with the chip selection. To select the cross-point can be accomplished with data bits D 0 to D3 operated with the chip selecting signal. These 4 data bits select one of the sixteen (1 6) cross-points.

2.11 HANDSET INTERFACE CIRCUIT

The keyset is equipped with a handset of transducers are dynamic unit and condenser micro-

phone.

The physical voice signal is transduced to the electrical signal through the moving TX condenser Micro-phone and the received electrical signal is transduced to the physical voice signal through the RX dynamic unit.



HANDSET INTERFACE AND VOLUME CONTROL CIRCUIT

The electrical generated from the TX Condenser Micro-phone is a weak signal and it requires the large amplification without noise. The TX signal is fed to the handset TX interface through the serial coupling capacitor.
The condenser Micro-phone is require base voltage around $2V_{DC}$.

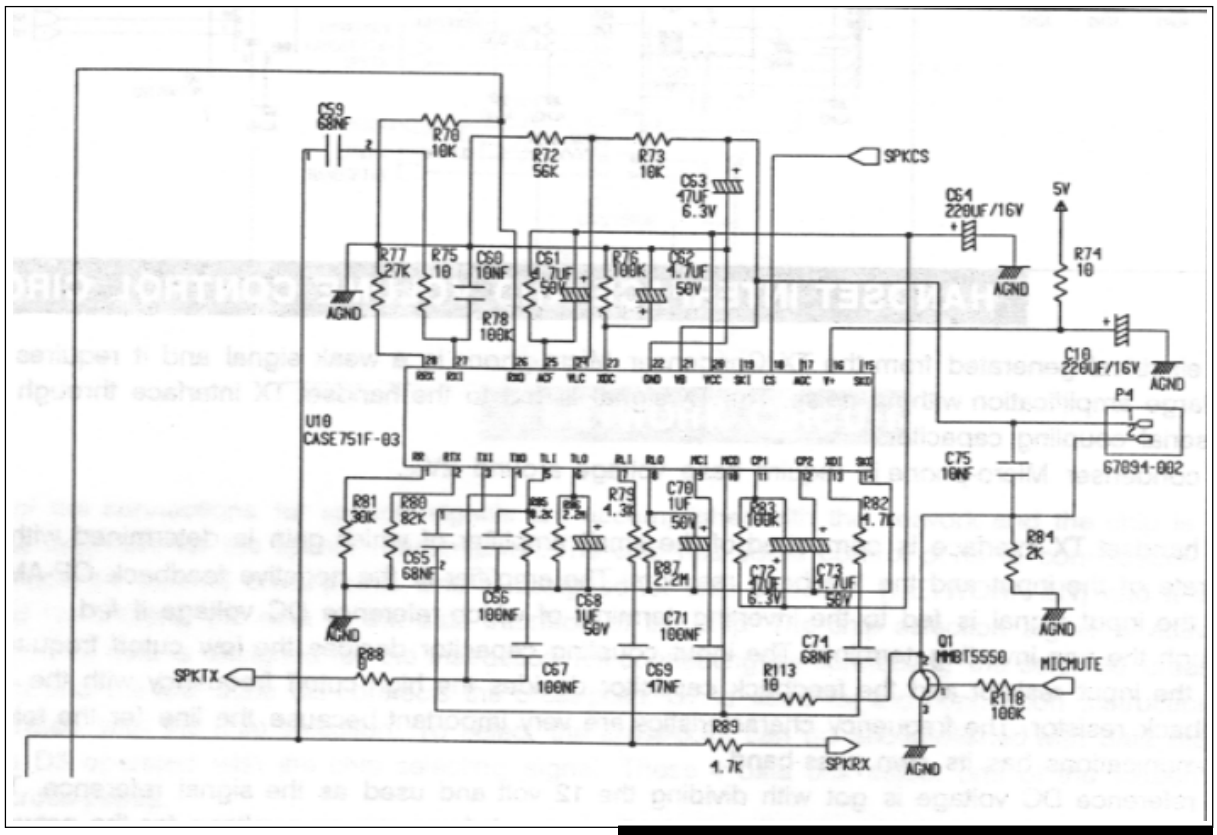
The handset TX interface is composed of the small amplifier of which gain is determined with the rate of the input and the feedback resistors. The amplifier is the negative feedback OP-AMP and the input signal is fed to the inverting terminal of which reference DC voltage if fed through the non-inverting terminal. The input coupling capacitor decides the low cutoff frequency with the input resistor and the feedback capacitor decides the high cutoff frequency with the feedback resistor. The frequency characteristics are very important because the line for the tele-communications has its own pass-band.
The reference DC voltage is got with dividing the 12 volt and used as the signal reference. The zener diode connected to the output protects the network from any over-voltage for the network path is set from GND to 5 volts. The output of the TX interface is fed to network and it may be connected to the other interface there if necessary.

The received signals fed from the network are connected to the handset RX Volume Control circuit. The handset RX Volume Control Circuit is composed of analog switch and some passive devices. The principle is very simple.
Switch-on decreases the input resistance of the handset RX amplifier and results in increasing the gain. Based on three control paths [H/S GAIN1], [H/S GAIN2], and [H/S GAIN3], the handset RX volume varies by eight steps.
The volume can be manipulated with the volume up/down button touch during handset speech case.

The varistor connected between the terminals of OP-AMP protects the user from any acoustic shock. The signal reference DC is fed through the non-inverting terminal and the gain of the amplifier is determined with the rate of the input and the feedback resistors, which may vary according to the handset RX volume control.
The input signals are fed to the inverting terminal and the key confirmation tone signals are also fed to the terminal.
The output is connected to the handset RX dynamic unit through the serial resistor and the coupling capacitor.

For handset interface, RC5532, dual OP-AMP chip is used for the two small signal amplifiers, of which driving power is 12 volts.

2.12 SPEAKER-PHONE CIRCUIT



SPEAKER PHONE CIRCUIT

All the keysets are equipped with speaker-phone facility basically. Compared with handset speech, speaker-phone can be accomplished with short-time half duplex. Otherwise, a howling

may disturb the communications because the micro-phone and the speaker have the capability to cover the large area compared with handset speech. Therefore, a automatic half-duplex switch device is essential to the speaker-phone facility.

MC34018 supplied by Motorola is the main device to switch RX/TX automatically. The main feature of the chip is switching TX/RX based on the level of which changeover speed is also adjusted with the external passive devices. The chip requires so many external devices and all of them have their meanings. For the detail operations and the applications, refer to the data sheet supplied by Motorola.

The chip is supplied with 5 volt power and it has the chip selector activated by the low state. So, the chip selection signal should be activated for the speaker-phone operation. The 5 volt power is supplied through the RC filter to prevent the switching noise.

For the transmitting transducer, a condenser micro-phone is applied, which requires the driving DC voltage. The micro-phone is assembled with the wire harness and connected through 2 pin connector. The condenser micro-phone has the polarity.
The generated electrical signal is fed to the analog switch which is prepared to control speaker -phone mute. The control signal is one of CPU ports, [SPK MUTE] and the low state dis-connects the path and results in the mute facility of speaker-phone.
The signals through the transistor, MMBT5550, flow to the speaker-phone chip and are amplified there. The amplified signals are attenuated and fed to the internal comparator to decide switching. If the switch is selected to tX, then the signals may be connected to the other interface through the network.
The received signals from the network are fed to the chip and attenuated and compared with the transmit signals for switching. If the switch is selected to RX the signals are fed to the speaker volume control circuit.

To adjust the switching facility is very difficult because there are so many call cases and so many loop cases. The switching mechanism is very simple but to set the feature to operate well at any case is tiresome.
The speaker-phone facility may be improved by the trial and error based on the field reports. Your practical and honest reports may be helpful to us.

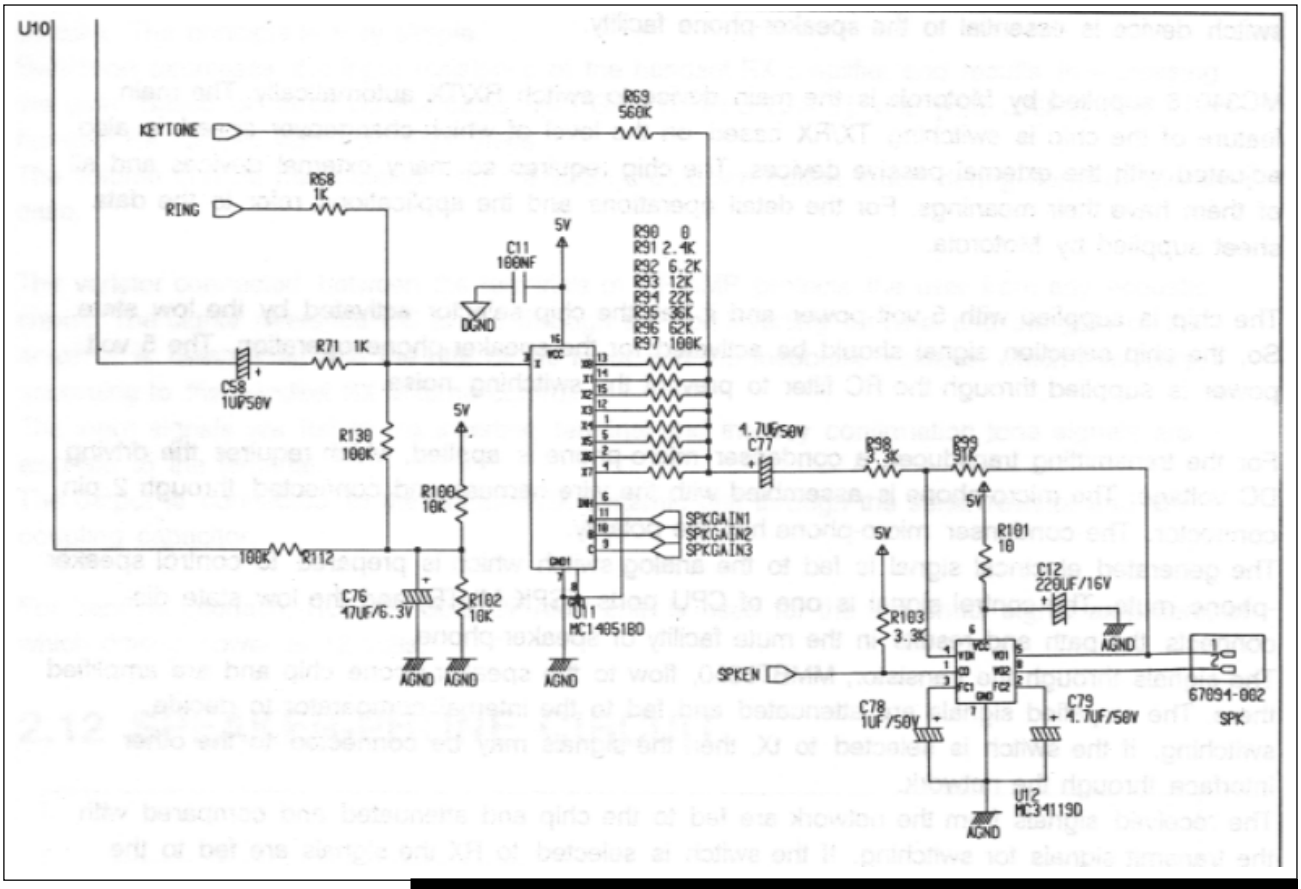
2.13 SPEAKER DRIVER WITH VOLUME CONTROL

The product uses 0.3W, 32 ohm loud speaker and uses MC34119 as the speaker driver. The driver is supplied with 5 volt power through the RC filter to prevent the driving noise from interfering the other circuits. The output terminating resistor and capacitor may block any unpredicted oscillation. The speaker driver input is fed from the speaker volume control circuit.

The speaker volume control circuit is composed of three analog switches and some passive devices. As described, the volume control circuit is used to adjust the speaker-phone RX volume as well as the ring-tone volume. The volume levels according to the control signals are same with the table described at the description section of the ring-tone generator.
The input of the volume control circuit is connected to the speaker-phone RX and ring-tone generator, and the node is also connected to the external speaker interface circuit.
One of the key confirmation tone outputs is connected to the speaker driver directly.

The volume control circuit operates for the speaker-phone as well as ring-tone signals but the

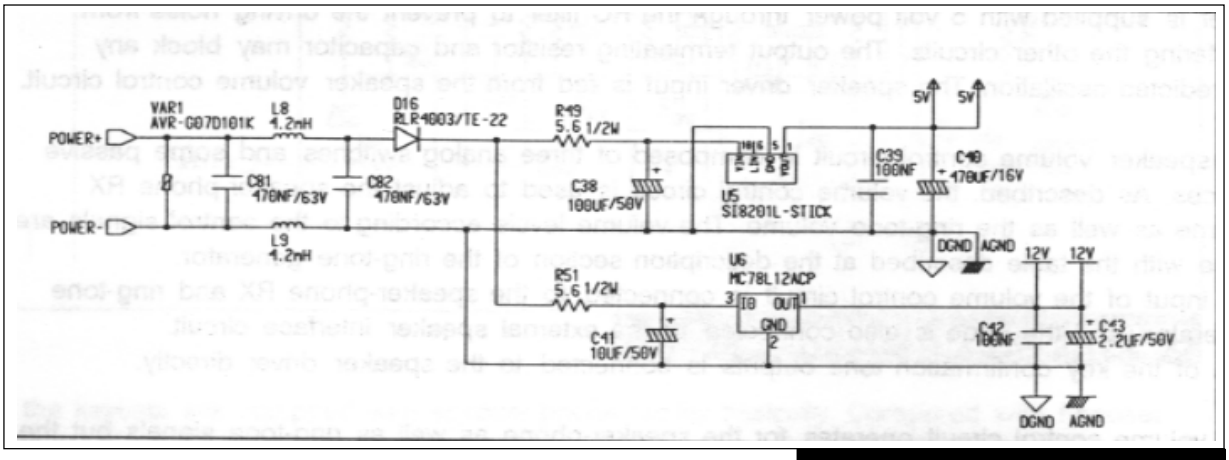
control logics are manipulated respectively.



SPEAKER DRIVER WITH VOLUME CONTROL

2.14 POWER REGULATOR

The product uses **5 volt and 12 volt power** for the operations. The main power is about 24 volts supplied from KSU through the center-tapped terminals of data and speech transformers. The reference potential is fed through the speech path and the high potential is fed through the data path. The power is converted to 5 volt and 12 volt with DC-DC convertors.
For 5 volt regulation, Si8201L is applied, which is the hybrid component including 5 volt



POWER CIRCUIT

switching regulator.

The electrical characteristics are as follows;

Input Voltage	45V max
Output Voltage	5.0V typ
Output Current	400mA max

And, 78L12 is applied to 12 volt regulator. That is the linear regulator of which input voltage is 35V max. Zener diode 1N4752A is also applied for over-voltage protection.

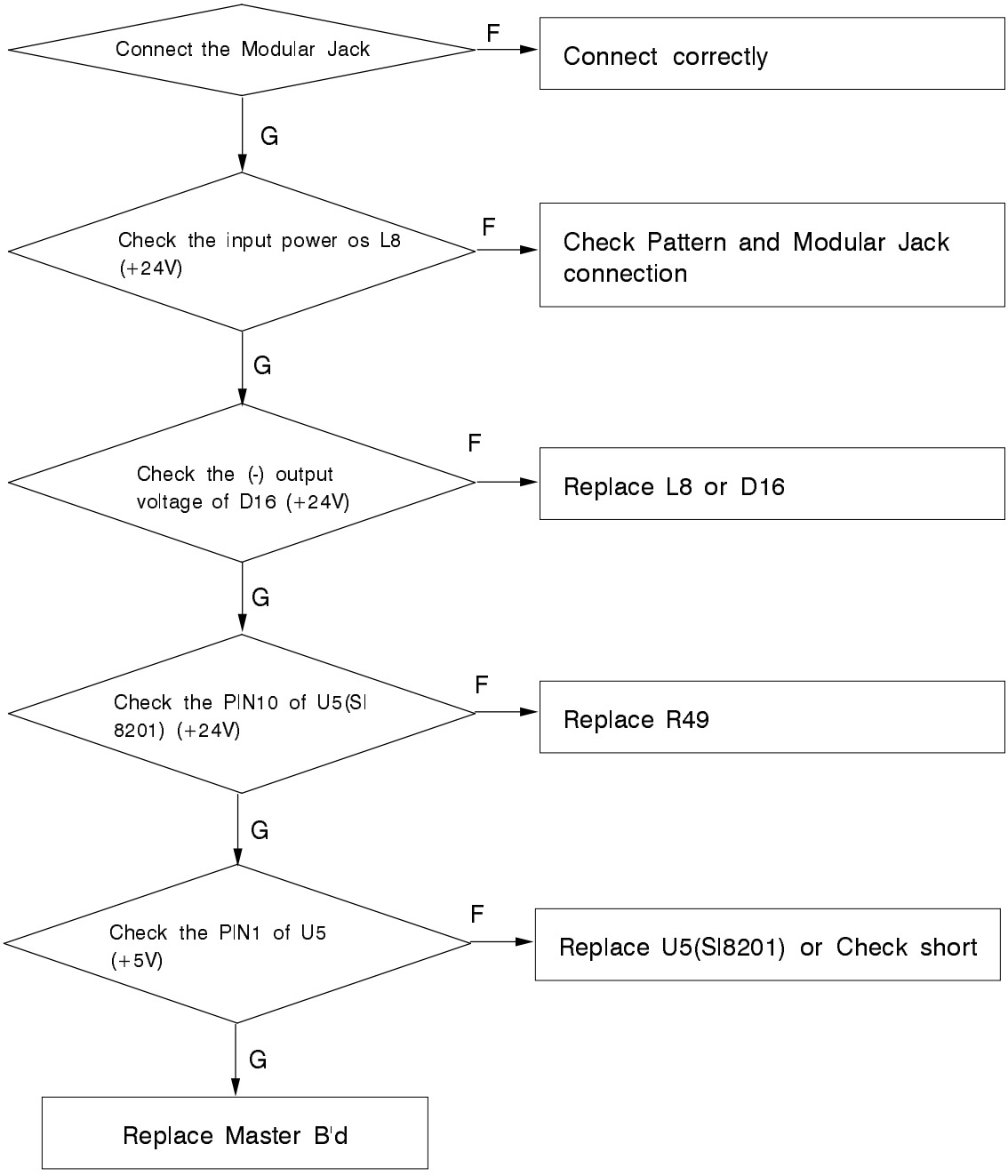
5 volt power is applied to all the logic parts and some speech circuitry, the network, the speaker-phone circuit, and the speaker driver. 12 volt power is applied to handset speech circuit, speech hybrid circuit, and the data communication circuit.

3. TROUBLE SHOOTING

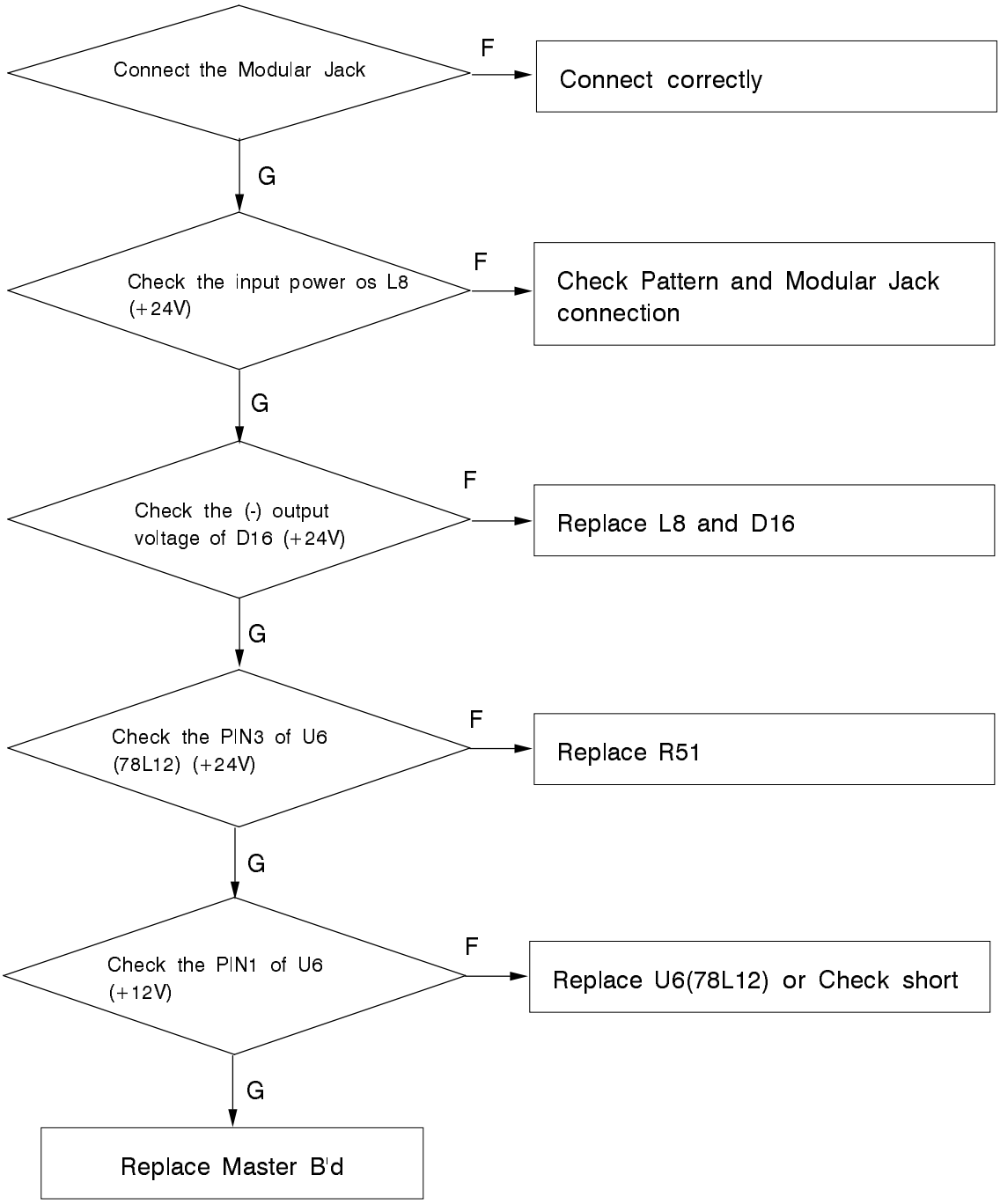
3.1 +5V Power Failure.....1
3.2 +12V Power Failure.....2
3.3 LED Failure.....3
3.4 KEY Detection Failure.....4
3.5 LCD Display Failure.....5
3.6 Ring Failure.....6
3.7 Handset/Speakerphone Call Failure.....7
3.8 Handset Call Failure.....8
3.9 Speakerphone Call Failure.....9

3. TROUBLE SHOOTING

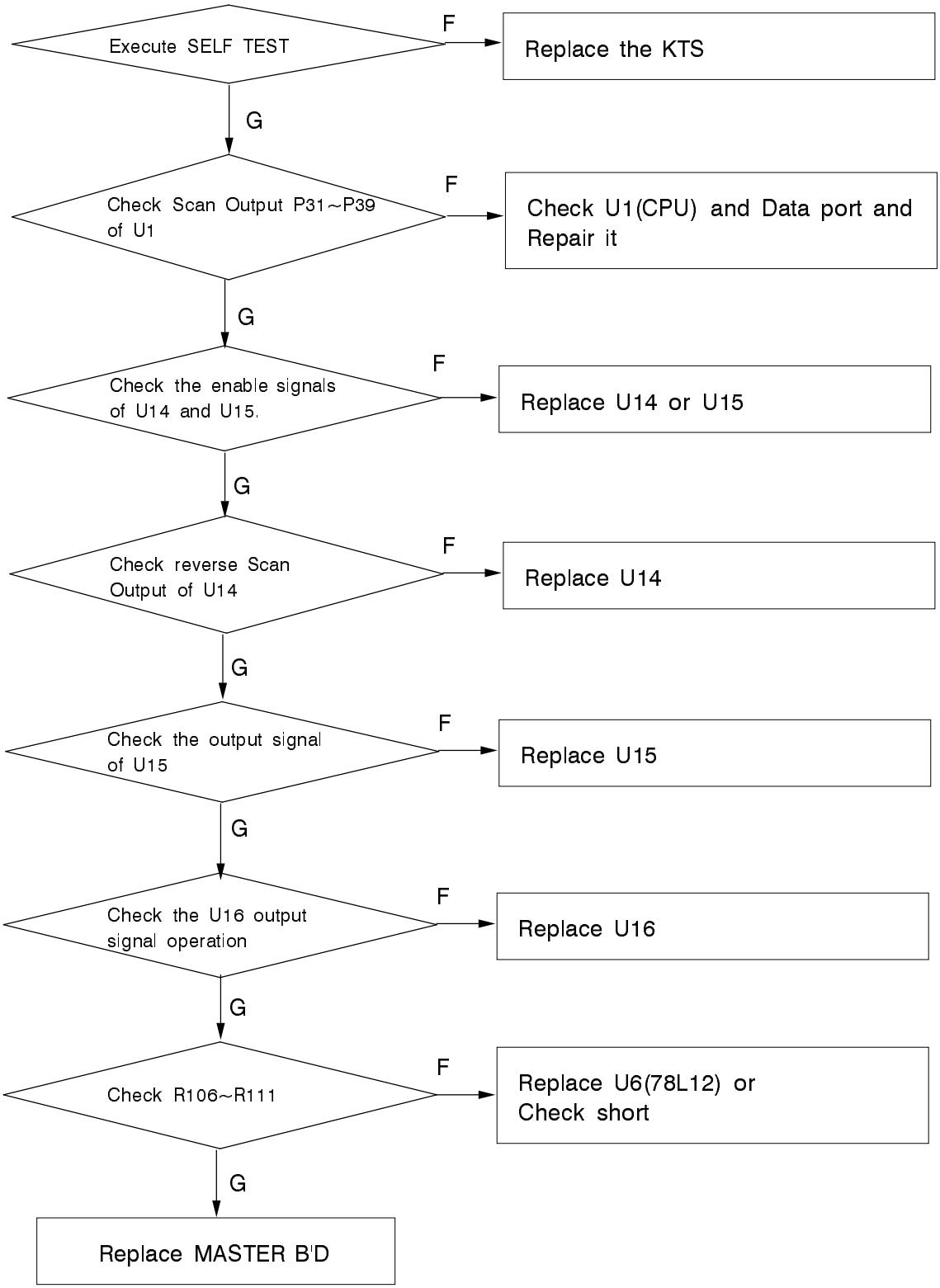
3.1 +5V Power Failure



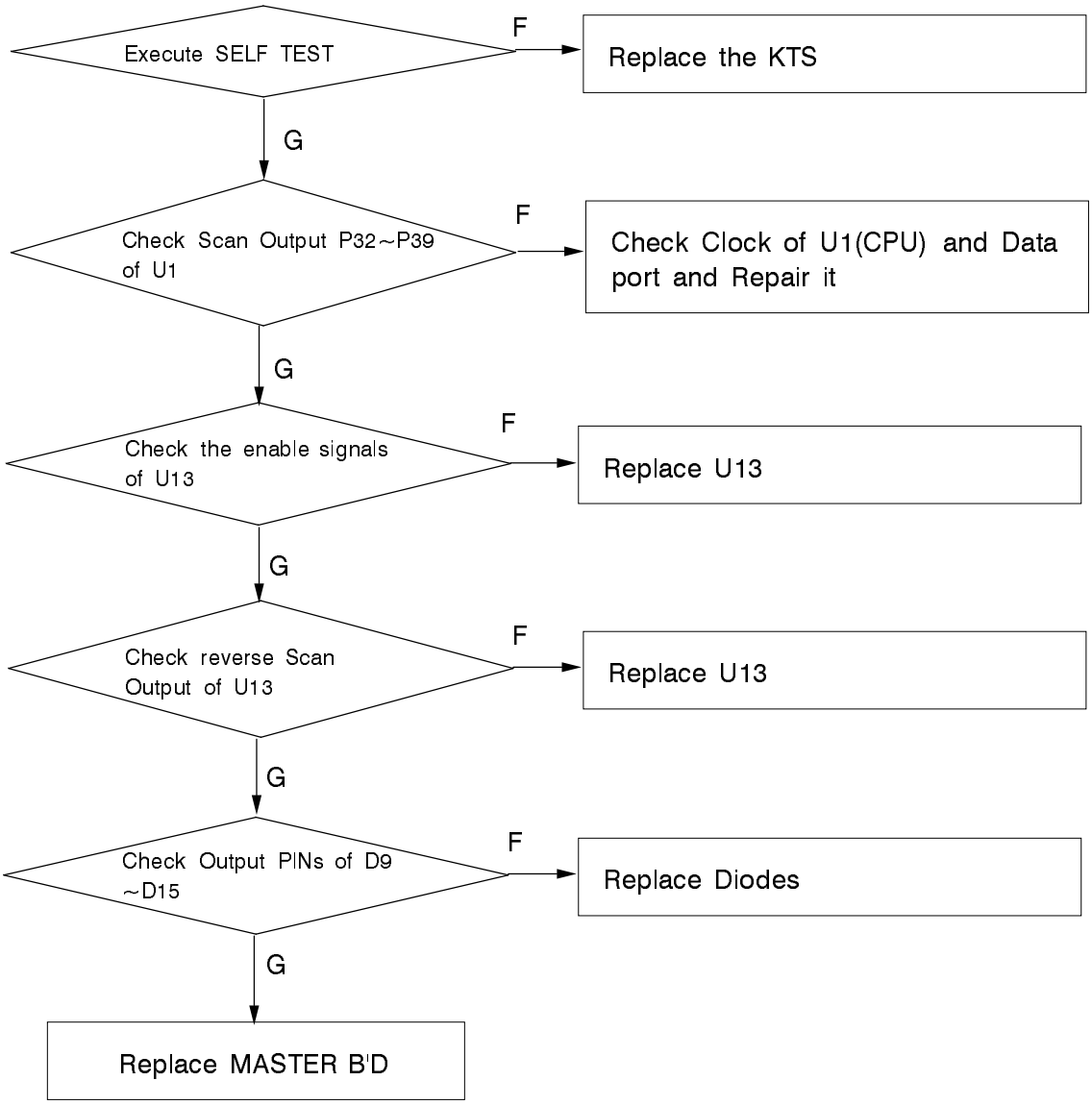
3.2 +12V Power Failure



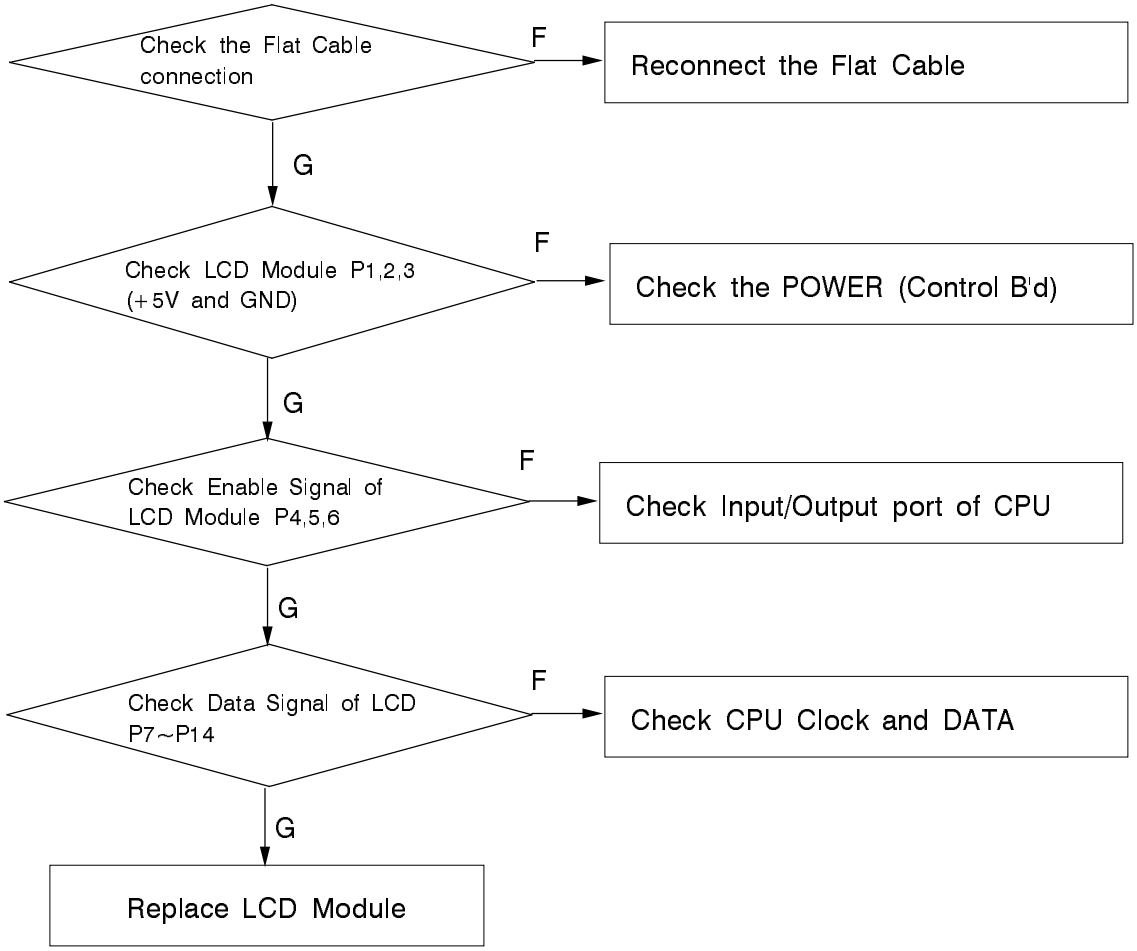
3.3 LED Failure



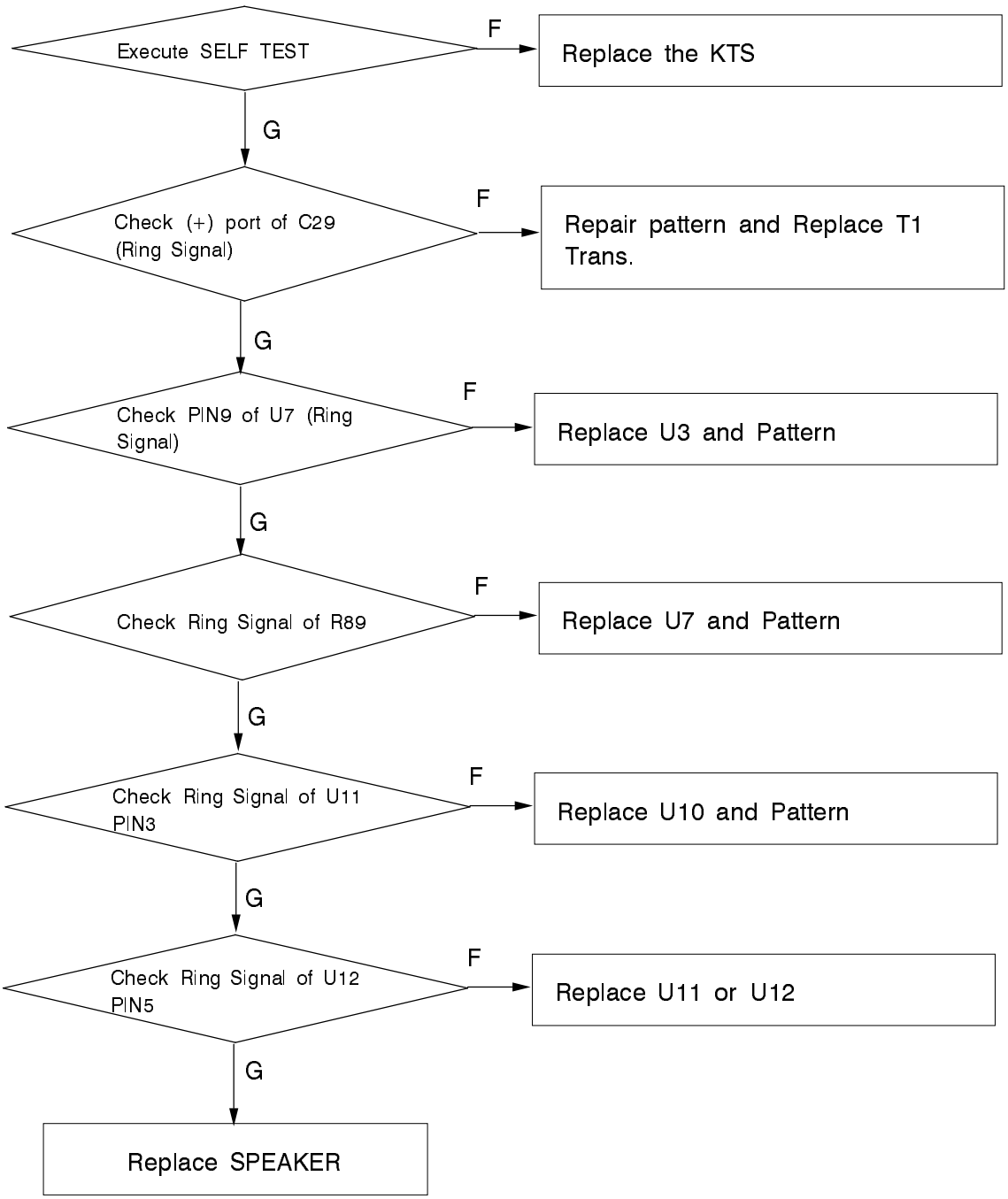
3.4 KEY Detection Failure



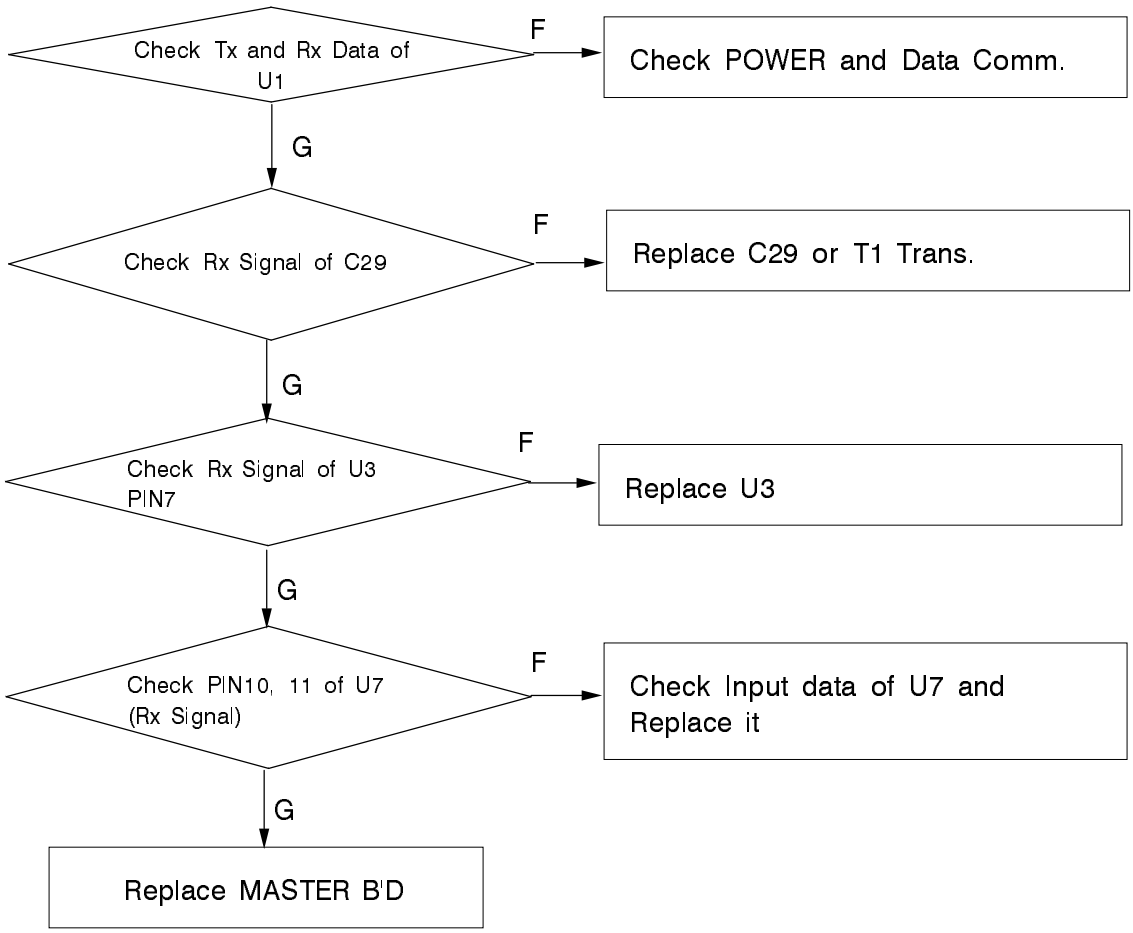
3.5 LCD Display Failure



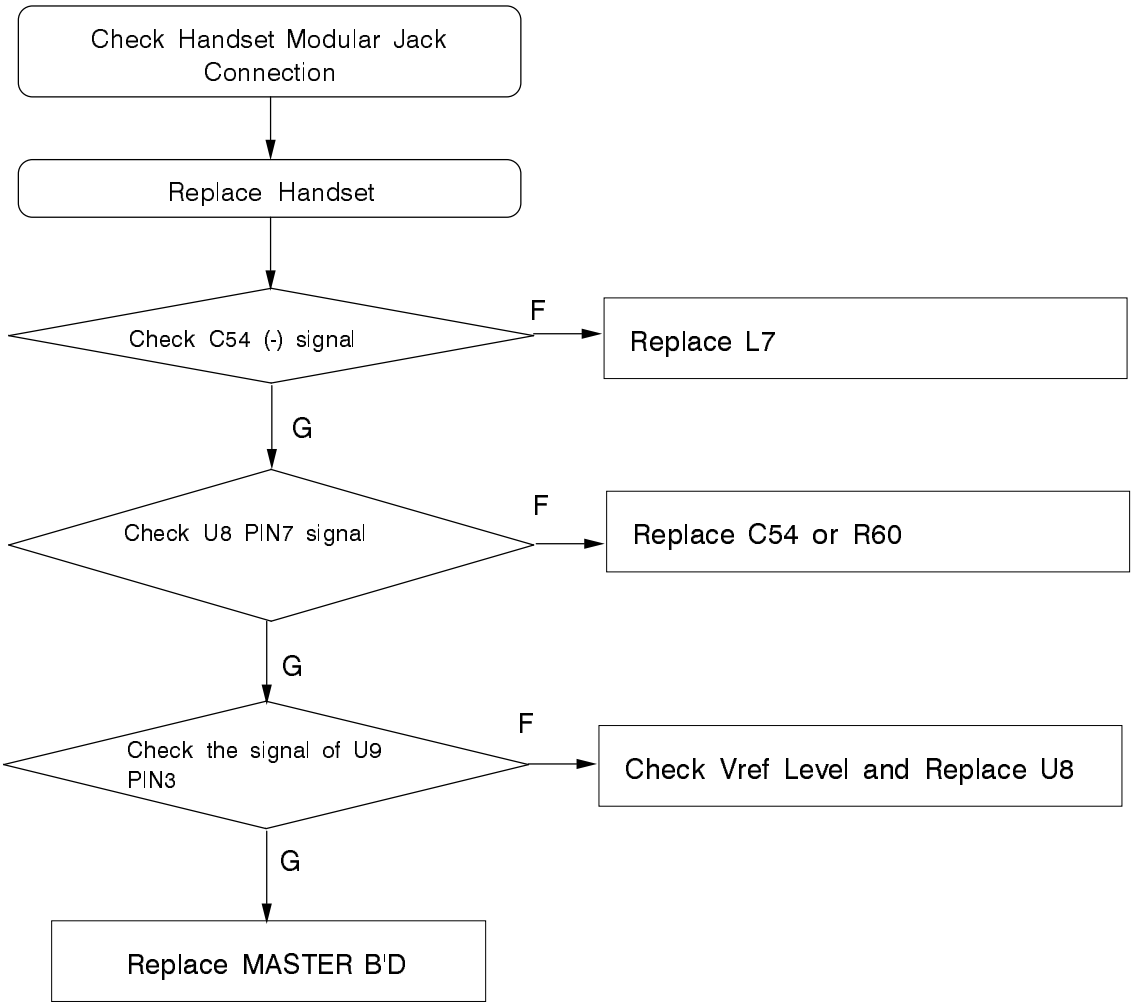
3.6 Ring Failure



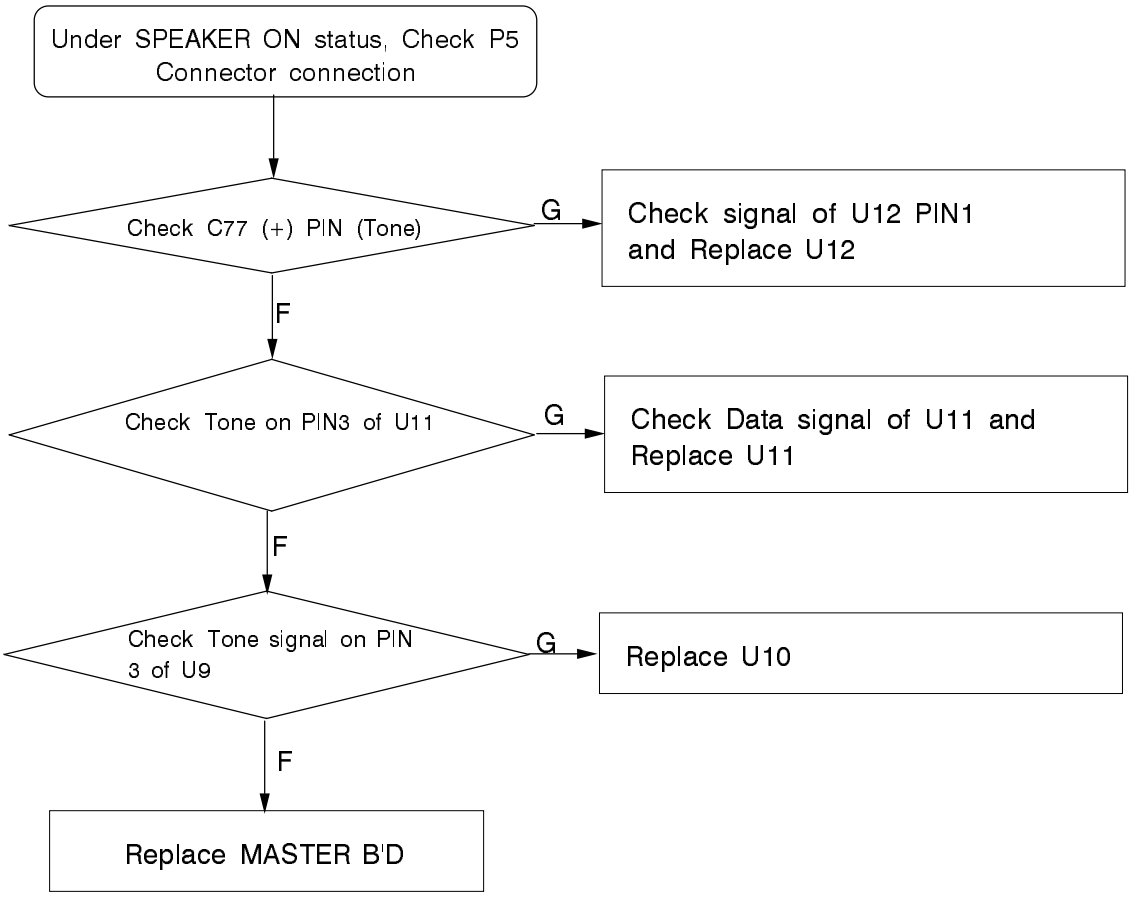
3.7 Handset/Speakerphone Call Failure



3.8 Handset Call Failure



3.9 Speakerphone Call Failure



5. EXPLODED VIEW AND PARTS LIST

5.1 NX-24 (W/L) KEYSET

5.1.1 EXPLODED VIEW.....1

5.1.2 PARTS LIST.....2

5.2 NX-24 KEYSET

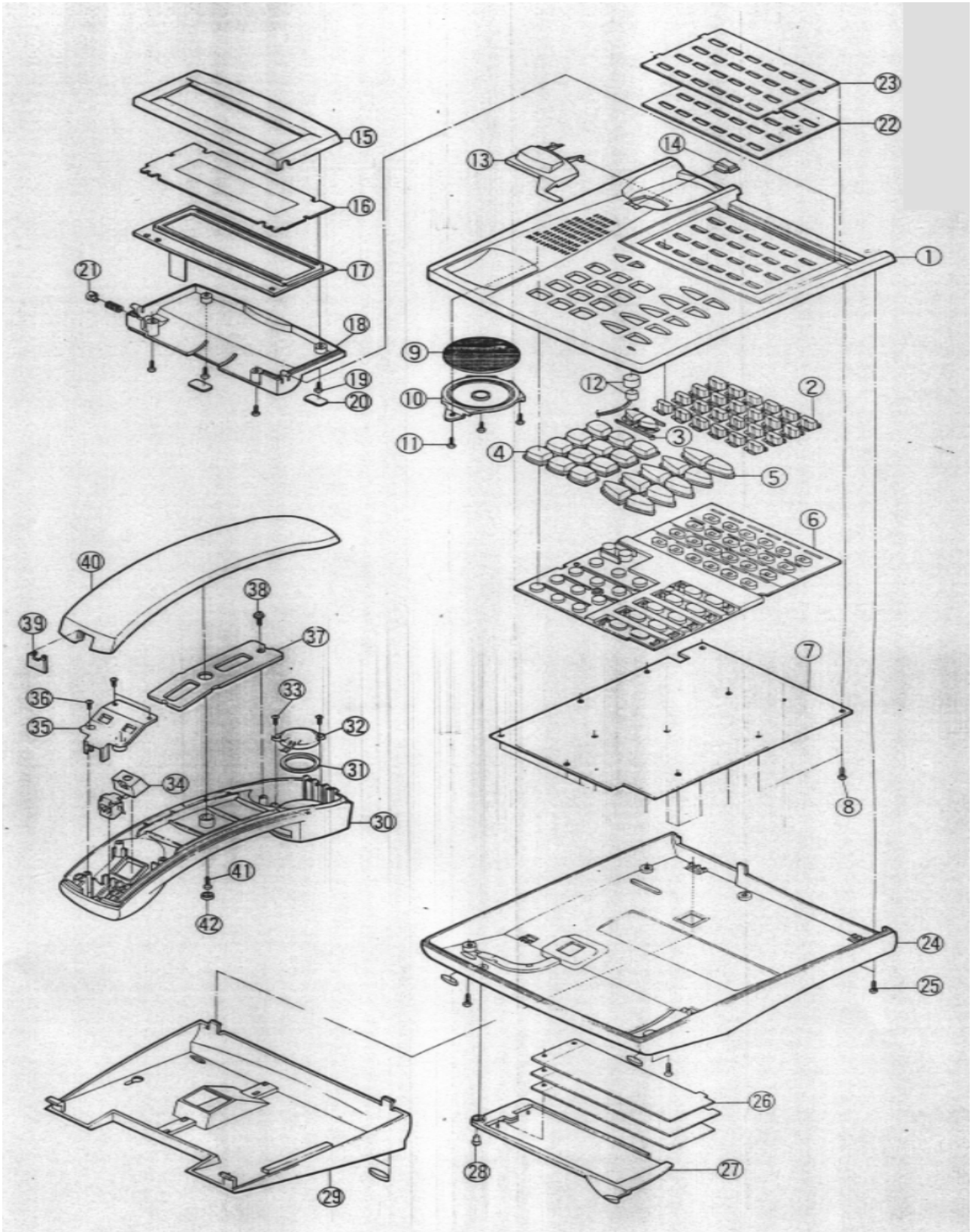
5.2.1 EXPLODED VIEW.....4

5.2.2 PARTS LIST.....5

5. EXPLODED VIEW AND PARTS LIST

5.1 NX-24(W/L) KEYSET

5.1.1 EXPLODED VIEW



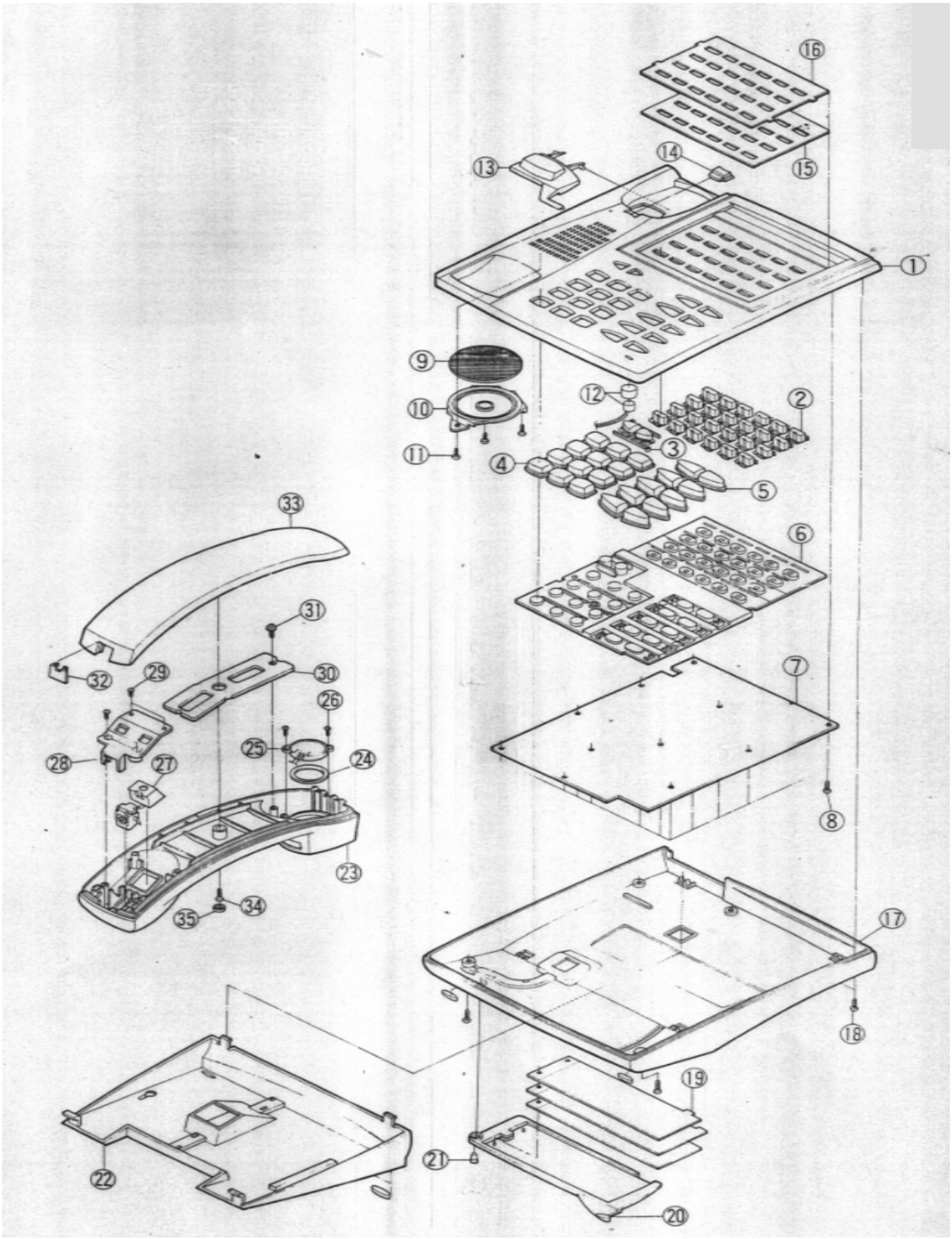
5.1.2 PARTS LIST

NO	SEC CODE	DESCRIPTION
①	GA72-40784A	TOP HOUSING, W/L
②	GA72-40787A	DSS KEY TOP
③	GA72-40788A	VOLUME KEY TOP
④	GA72-40741A	3 4 KEY TOP
⑤	GA72-40789A	FUNCTION KEY TOP
⑥	GA72-40525A	CONDUCTIVE RUBBER
⑦	GA92-01163A	24 PCB
⑧	6002-000154	TAPPING,2,M3.L8
⑨	GA69-20627A	SPEAKER PAD
⑩	GA96-00639A	SPK ASS'Y
⑪	6002-000154	TAPPING,2,M3.L8
⑫	GA96-00651A	MIKE ASS'Y
⑬	GA72-40786A	PLUNGER
⑭	GA72-40721A	HANGER
⑮	GA72-40782A	LCD MODULE UPPER
⑯	GA72-10563A	LCD MODULE WINDOW
⑰	GA07-20056A	LCD DISPLAY, 16DIG
⑱,㉑	GA75-10576A	LCD LOWER ASS'Y
⑲	6002-000147	TAPPING,2,M3.L10
⑳	GA73-10005A	LCD MODULE RUBBER
㉒	GA68-11199A	NUMBERING PAPER
㉓	GA72-10564A	NUMBERING COVER
㉔	GA75-10574A	W/L BASE ASS'Y
㉕	6002-000147	TAPPING,2,M3.L10
㉖	GA68-11183A GA68-11185A GA68-11187A	INDEX PAPER
㉗	GA72-40727A	INDEX CARD
㉘	6041-000116	MISCEL, D3, L5.5
㉙	GA75-10562A	WALL MOUNT ASS'Y
㉚	GA72-40712A	HANDSET LOWER
㉛	GA69-20631A	RX-UNIT PAD
㉜	3009-000149	AUDIO-UNIT
㉝	6002-000154	TAPPING,2,M3.L8
㉞	3003-000117	AUDIO-MIC
㉟	GA72-40716A	TX-BRTK
㊲	GA70-10683A	WEIGHT BALANCE
㊳	6003-000214	TAPTITE,M3,L8
㊴	GA72-40714A	HANDSET HOLDER

NO	SEC CODE	DESCRIPTION
㊵	GA72-40710A	HANDSET UPPER
㊶,㊱	6002-000154	TAPPING,2,M3.L8
㊷	GB72-40792A	HOLE DUMMY

5.2 NX-24 KEYSET

5.2.1 EXPLODED VIEW



5.2.2 PARTS LIST

NO	SEC CODE	DESCRIPTION
①	GA72-40793A	TOP HOUSING
②	GA72-40787A	DSS KEY TOP
③	GA72-40788A	VOLUME KEY TOP
④	GA72-40741A	3 4 KEY TOP
⑤	GA72-40789A	FUNCTION KEY TOP
⑥	GA72-40525A	CONDUCTIVE RUBBER
⑦	GA92-01163A	24 PCB
⑧	6002-000154	TAPPING,2,M3.L8
⑨	GA69-20627A	SPEAKER PAD
⑩	GA96-00639A	SPK ASS'Y
⑪	6002-000154	TAPPING,2,M3.L8
⑫	GA96-00651A	MIKE ASS'Y
⑬	GA72-40786A	PLUNGER
⑭	GA72-40721A	HANGER
⑮	GA68-11199A	NUMBERING PAPER
⑯	GA72-10564A	NUMBERING COVER
⑰	GA75-10575A	BASE ASS'Y
⑱	6002-000147	TAPPING,2,M3.L10
⑲	GA68-11183A	INDEX PAPER
	GA68-11185A	
	GA68-11187A	
⑳	GA72-40727A	INDEX CARD
㉑	6041-000116	MISCEL, D3, L5.5
㉒	GA75-10562A	WALL MOUNT ASS'Y
㉓	GA72-40712A	HANDSET LOWER
㉔	GA69-20631A	RX-UNIT PAD
㉕	3009-000149	AUDIO-UNIT
㉖	6002-000154	TAPPING,2,M3.L8
㉗	3003-000117	AUDIO-MIC
㉘	GA72-40716A	TX-BRTK
㉚	GA70-10683A	WEIGHT BALANCE
㉛	6003-000214	TAPTITE,M3,L8
㉜	GA72-40714A	HANDSET HOLDER
㉝	GA72-40710A	HANDSET UPPER
㉙,㉞	6002-000154	TAPPING,2,M3.L8
㉟	GB72-40792A	HOLE DUMMY

PBA PARTS LIST

4.1 24 BUTTON KEYSET(GA92-01163A)

4.1.1 COMPONENT SIDE.....1

4.1.2 SOLDER SIDE.....2

4.1.3 PARTS LIST.....3

4.2 12 BUTTON KEYSET(GA92-01167A)

4.2.1 COMPONENT SIDE.....6

4.2.2 SOLDER SIDE.....7

4.2.3 PARTS LIST.....8

4.3 6 BUTTON KEYSET(GA92-01171A)

4.3.1 COMPONENT SIDE.....11

4.3.2 SOLDER SIDE.....12

4.3.3 PARTS LIST.....13

4.4 DSS BOX(Add-On-Module)(GA92-01173A)

4.4.1 COMPONENT SIDE.....16

4.4.2 SOLDER SIDE.....17

4.4.3 PARTS LIST.....18

4. PBA LAYOUT AND PARTS LIST

4.1 24 BUTTON KEYSET(GA92-01163A)

PARTS LIST

NO	SEC CODE	DESCRIPTION	Q'TY	PART LOCATION
1	EC26-20501A	TRANS-AF,5692,800mH	2	T1,T2
2	GA13-10108A	IC-HYB,SI8201	1	U5
3	GA41-10601A	PCB 24LINE	1	
4	0401-000128	DIODE-SWITCHING,HSK-120	16	D1-D15,D17
5	0402-000305	DIODE-RECTIFIER,RLR4003	1	D16
6	0403-000524	DIODE-ZENER,1N4732A,4.7V	1	ZD1
7	0501-000477	TR-SMALL SIGNAL,MMBT5550	1	Q1
8	0601-000202	LED-CHIP,RED/YEL	12	COL1-COL12
9	0601-000208	LED-CHIP,RED	16	SDL1-SDL12,SKP,HLD,MES,MUT
10	0801-000690	74HC373	3	U13,U14,U15
11	1001-000135	IC-ANALOG SWITCH,CD22000E	1	U7
12	1001-000170	IC-ANALOG SWITCH,MC14051B	2	U9,U11
13	1201-000105	IC-AUDIO AMP,34119,SOP,8P	1	U12
14	1201-000423	IC-OP AMP,4558,SOP,8P	2	U3,U8
15	1202-000161	IC-VOLTAGE COMP,393,SOP	1	U2
16	1203-000161	IC-POSI ADJUST REGULATOR	1	U6
17	1204-000278	IC-SPEAKPHONE,MC34018,SOP	1	U10
18	1405-000164	VARISTOR,68V,250A	1	VAR1
19	2007-000285	R-CHIP,100K,5%,1/8W	12	R1,7,8,17,48,76,78,83,97,112,118,130
20	2007-000293	R-CHIP,100,5%,1/8W	4	R106,107,110,111
21	2007-000299	R-CHIP,10K,1%,1/8W	1	R3
22	2007-000303	R-CHIP,10K,5%,1/8W	10	R13,16,29,41,44,70,73,100,102,121
23	2007-000312	R-CHIP,10,5%,1/8W	7	R37,74,75,101,108,109,113
24	2007-000341	R-CHIP,120K,5%,1/8W	2	R55,56
25	2007-000359	R-CHIP,12K,5%,1/8W	3	R35,46,93
26	2007-000382	R-CHIP,13K,5%,1/8W	1	R65
27	2007-000412	R-CHIP,15K,5%,1/8W	2	R25,120
28	2007-000451	R-CHIP,180,5%,1/8W	2	R11,12
29	2007-000472	R-CHIP,1K,5%,1/8W	6	R4,22,53,58,68,71,
30	2007-000500	R-CHIP,2.2M,5%,1/8W	2	R86,87
31	2007-000513	R-CHIP,2.4K,5%,1/8W	1	R91
32	2007-000521	R-CHIP,2.7K,5%,1/8W	1	R42
33	2007-000548	R-CHIP,20K,5%,1/8W	3	R15,59,119
34	2007-000589	R-CHIP,22K,5%,1/8W	2	R27,94
35	2007-000617	R-CHIP,24K,5%,1/8W	1	R26
36	2007-000656	R-CHIP,27K,5%,1/8W	3	R45,77,117
37	2007-000674	R-CHIP,2K,5%,1/8W	3	R5,43,84

NO	SEC CODE	DESCRIPTION	Q'TY	PART LOCATION
38	2007-000688	R-CHIP,3.3K,5%,1/8W	2	R98,103
39	2007-000725	R-CHIP,300K,5%,1/8W	1	R10
40	2007-000740	R-CHIP,30K,5%,1/8W	3	R38,40,81
41	2007-000806	R-CHIP,36K,5%,1/8W	1	R95
42	2007-000824	R-CHIP,390,5%,1/8W	2	R28,52
43	2007-000855	R-CHIP,4.32K,1%,1/8W	1	R6
44	2007-000861	R-CHIP,4.3K,5%,1/8W	3	R31,32,79
45	2007-000875	R-CHIP,4.7K,5%,1/8W	10	R14,18,19,39,50,61,82,89,104,122
46	2007-000934	R-CHIP,470,5%,1/8W	1	R9
47	2007-000985	R-CHIP,5.6,2%,1/2W	2	R49,51
48	2007-001041	R-CHIP,56K,5%,1/8W	1	R72
49	2007-001057	R-CHIP,6.2K,5%,1/8W	1	R92
50	2007-001099	R-CHIP,62K,5%,1/8W	2	R66,96
51	2007-001121	R-CHIP,680,5%,1/8W	1	R36
52	2007-001144	R-CHIP,7.5K,5%,1/8W	2	R54,57
53	2007-001180	R-CHIP,8.2K,5%,1/8W	1	R85
54	2007-001203	R-CHIP,820,5%,1/8W	2	R2,47
55	2007-001212	R-CHIP,82K,5%,1/8W	1	R80
56	2007-001246	R-CHIP,91K,5%,1/8W	1	R99
57	2007-000768	R-CHIP,330,5%,1/8W	1	R24
58	2007-000777	R-CHIP,33K,5%,1/8W	1	R116
59	2007-000944	R-CHIP,47K,5%,1/8W	1	R30
60	2007-000542	R-CHIP,200,5%,1/8W	1	R60
61	2007-000914	R-CHIP,43K,5%,1/8W	1	R114
62	2007-000705	R-CHIP,3.6K,5%,1/8W	1	R20
63	2007-001197	R-CHIP,820K,5%,1/8W	1	R132
64	2007-001027	R-CHIP,560K,5%,1/8W	1	R69
65	2007-000464	R-CHIP,18,5%,1/8W	1	R105
66	911-710007CR	REF-CHIP,0,5%,1/8W	11	R23,33,88,90,124,126,128,L2
67	2203-000789	C-CERAMIC,CHIP,330pF,20%	2	-5C88,89
68	2203-000262	C-CERAMIC,CHIP,10nF,10%	6	C46,47,53,57,60,75
69	2203-000376	C-CERAMIC,CHIP,15nF,10%	1	C83
70	2203-000557	C-CERAMIC,CHIP,20pF,5%	2	C22,23
71	2203-000717	C-CERAMIC,CHIP,3.3nF,10%	1	C35
72	2203-000805	C-CERAMIC,CHIP,33nF,10%	1	C85
73	2203-000841	C-CERAMIC,CHIP,390pF,5%	2	C48,C50
74	2203-000955	C-CERAMIC,CHIP,470pF,5%	4	C25,52,87,90
75	2203-001145	C-CERAMIC,CHIP,68nF,10%	4	C31,59,65,74
76	2203-001450	C-CERAMIC,CHIP,100nF,10%	12	C1,2,7,9,11,13,14,15,16,C18,20,21

NO	SEC CODE	DESCRIPTION	Q'TY	PART LOCATION
77	2203-001452	C-CERAMIC,CHIP,100nF,20%	13	C17,28,30,36,39,42,45,55 C56,66,67,71,80
78	2203-001511	C-CERAMIC,CHIP,47nF,10%	1	C69
79	2305-000587	C-FILM,MOEF,470nF,10%,63V	2	C81,82
80	2401-000282	C-AL,100uF,20%,16V	3	C32,37,51
81	2401-000802	C-AL,220uF,20%,16V	7	C3,4,8,10,12,64,86
82	2402-000120	C-AL,SMD,10uF,20%,50V	1	C41
83	2402-000130	C-AL,SMD,2.2uF,20%,50V	2	C29,43
84	2402-000165	C-AL,SMD,47uF,20%6.35V	4	C44,63,72,76

NO	SEC CODE	DESCRIPTION	Q'TY	PART LOCATION
85	2402-000170	C-AL,SMD,1uF,20%,50V	7	C19,24,33,58,68,70,78
86	2402-000173	C-AL,SMD,4.7uF,20%,35V	6	C54,61,62,73,77,79
87	2703-000343	INDUCTOR,SMD,220uH,10%	4	L10,11,12,13
88	3301-000345	CORE-FERRITE BEAD	1	L1
89	3704-000275	SOCKET-IC,40P,DIP	1	U1
90	3708-000157	CONNECTOR-FPC/FC/PIC,14P	1	P1
91	3722-000269	JACK-MODULAR,6P/6C	1	P2
92	881-105532AA	IC-LIN,5532,OP-AMP,DIP	1	U4
93	881-802003GA	IC-LIN,2003,DAR-TR ARRY	1	U16
94	897-130505AB	VARISTOR,1.5V,0.3W	1	VR1
95	GC39-50060A	CBF-LINE CORD,HA,2000 mm	1	
96	JF27-30053A	COIL-RF,SF2600,4mH,7.50HM	2	L8,9
97	0903-000178	IC-MICROCONTROLLER,8751	1	U1
98	2011-000582	R-NETWORK,47K,5%,1/8W	1	RA1
99	2401-000355	C-AL,100uF,20%,50V	1	C38
100	2401-001368	C-AL,470uF,20%,16V	1	C40
101	3409-000121	SWITCH-HOOK,53V,100mA	1	H/S1
102	3711-000822	CONNECTOR-HEADERBOX,2P	2	P4,P5
103	3722-000265	JACK-MODULAR,4P/4C	1	P3
104	941-110040AA	CRYSTAL,11.0592M	1	Y1

4.2 12 BUTTON KEYSET(GA92-01167A)

PARTS LIST

NO	SEC CODE	DESCRIPTION	Q'TY	PART LOCATION
1	EC26-20501A	TRANS-AF,5692,800mH	2	T1,T2
2	GA13-10108A	IC-HYB,SI8201	1	U5
3	GA41-10602A	PCB 12LINE	1	
4	0401-000128	DIODE-SWITCHING,HSK-120	16	D1-D15,D17
5	0402-000305	DIODE-RECTIFIER,RLR4003	1	D16
6	0403-000524	DIODE-ZENER,1N4732A,4.7V	1	ZD1
7	0501-000477	TR-SMALL SIGNAL,MMBT5550	1	Q1
8	0601-000202	LED-CHIP,RED/YEL	6	COL1-COL6
9	0601-000208	LED-CHIP,RED	10	SDL1-SDL6,SKP,HLD,MES,MUT
10	0801-000690	74HC373	3	U13,U14,U15
11	1001-000135	IC-ANALOG SWITCH,CD22000E	1	U7
12	1001-000170	IC-ANALOG SWITCH,MC14051B	2	U9,U11
13	1201-000105	IC-AUDIO AMP,34119,SOP,8P	1	U12
14	1201-000423	IC-OP AMP,4558,SOP,8P	2	U3,U8
15	1202-000161	IC-VOLTAGE COMP,393,SOP	1	U2
16	1203-000161	IC-POSI ADJUST REGULATOR	1	U6
17	1204-000278	IC-SPEAKPHONE,MC34018,SOP	1	U10
18	1405-000164	VARISTOR,68V,250A	1	VAR1
19	2007-000285	R-CHIP,100K,5%,1/8W	12	R1,7,8,17,48,76,78,83,97,112,118,130
20	2007-000293	R-CHIP,100,5%,1/8W	4	R107,108,110,111
21	2007-000299	R-CHIP,10K,1%,1/8W	1	R3
22	2007-000303	R-CHIP,10K,5%,1/8W	10	R13,16,29,41,44,70,73,100,102,121
23	2007-000312	R-CHIP,10,5%,1/8W	6	R37,74,75,101,109,113
24	2007-000341	R-CHIP,120K,5%,1/8W	2	R55,56
25	2007-000359	R-CHIP,12K,5%,1/8W	3	R35,46,93
26	2007-000382	R-CHIP,13K,5%,1/8W	1	R65
27	2007-000412	R-CHIP,15K,5%,1/8W	2	R25,120
28	2007-000451	R-CHIP,180,5%,1/8W	2	R11,12
29	2007-000472	R-CHIP,1K,5%,1/8W	6	R4,22,53,58,68,71,
30	2007-000500	R-CHIP,2.2M,5%,1/8W	2	R86,87
31	2007-000513	R-CHIP,2.4K,5%,1/8W	1	R91
32	2007-000521	R-CHIP,2.7K,5%,1/8W	1	R42
33	2007-000548	R-CHIP,20K,5%,1/8W	3	R15,59,119
34	2007-000589	R-CHIP,22K,5%,1/8W	2	R27,94
35	2007-000617	R-CHIP,24K,5%,1/8W	1	R26
36	2007-000656	R-CHIP,27K,5%,1/8W	3	R45,77,117
37	2007-000674	R-CHIP,2K,5%,1/8W	3	R5,43,84
38	2007-000688	R-CHIP,3.3K,5%,1/8W	2	R98,103
39	2007-000725	R-CHIP,300K,5%,1/8W	1	R10
40	2007-000740	R-CHIP,30K,5%,1/8W	3	R38,40,81
41	2007-000806	R-CHIP,36K,5%,1/8W	1	R95
42	2007-000824	R-CHIP,390,5%,1/8W	2	R28,52

NO	SEC CODE	DESCRIPTION	Q'TY	PART LOCATION
43	2007-000855	R-CHIP,4.32K,1%,1/8W	1	R6
44	2007-000861	R-CHIP,4.3K,5%,1/8W	3	R31,32,79
45	2007-000875	R-CHIP,4.7K,5%,1/8W	10	R14,18,19,39,50,61,82,89,104,122
46	2007-000934	R-CHIP,470,5%,1/8W	1	R9
47	2007-000985	R-CHIP,5.6,2%,1/2W	2	R49,51
48	2007-001041	R-CHIP,56K,5%,1/8W	1	R72
49	2007-001057	R-CHIP,6.2K,5%,1/8W	1	R92
50	2007-001099	R-CHIP,62K,5%,1/8W	2	R66,96
51	2007-001121	R-CHIP,680,5%,1/8W	1	R36
52	2007-001144	R-CHIP,7.5K,5%,1/8W	2	R54,57
53	2007-001180	R-CHIP,8.2K,5%,1/8W	1	R85
54	2007-001203	R-CHIP,820,5%,1/8W	2	R2,47
55	2007-001212	R-CHIP,82K,5%,1/8W	1	R80
56	2007-001246	R-CHIP,91K,5%,1/8W	1	R99
57	2007-000768	R-CHIP,330,5%,1/8W	1	R24
58	2007-000777	R-CHIP,33K,5%,1/8W	1	R116
59	2007-000944	R-CHIP,47K,5%,1/8W	1	R30
60	2007-000542	R-CHIP,200,5%,1/8W	1	R60
61	2007-000914	R-CHIP,43K,5%,1/8W	1	R114
62	2007-000705	R-CHIP,3.6K,5%,1/8W	1	R20
63	2007-001197	R-CHIP,820K,5%,1/8W	1	R132
64	2007-001027	R-CHIP,560K,5%,1/8W	1	R69
65	2007-000464	R-CHIP,18,5%,1/8W	1	R105
66	911-710007CR	REF-CHIP,0,5%,1/8W	11	R23,33,88,90,124,126,128,L2-5C88,89
67	2203-000789	C-CERAMIC,CHIP,330pF,20%	2	
68	2203-000262	C-CERAMIC,CHIP,10nF,10%	6	C46,47,53,57,60,75
69	2203-000376	C-CERAMIC,CHIP,15nF,10%	1	C83
70	2203-000557	C-CERAMIC,CHIP,20pF,5%	2	C22,23
71	2203-000717	C-CERAMIC,CHIP,3.3nF,10%	1	C35
72	2203-000805	C-CERAMIC,CHIP,33nF,10%	1	C85
73	2203-000841	C-CERAMIC,CHIP,390pF,5%	2	C48,C50
74	2203-000955	C-CERAMIC,CHIP,470pF,5%	4	C25,52,87,90
75	2203-001145	C-CERAMIC,CHIP,68nF,10%	4	C31,59,65,74
76	2203-001450	C-CERAMIC,CHIP,100nF,10%	12	C1,2,7,9,11,13,14,15,16,C18,20,21
77	2203-001452	C-CERAMIC,CHIP,100nF,20%	13	C17,28,30,36,39,42,45,55C56,66,67,71,80
78	2203-001511	C-CERAMIC,CHIP,47nF,10%	1	C69
79	2305-000587	C-FILM,MOEF,470nF,10%,63V	2	C81,82
80	2401-000282	C-AL,100uF,20%,16V	3	C32,37,51
81	2401-000802	C-AL,220uF,20%,16V	7	C3,4,8,10,12,64,86
82	2402-000120	C-AL,SMD,10uF,20%,50V	1	C41
83	2402-000130	C-AL,SMD,2.2uF,20%,50V	2	C29,43
84	2402-000165	C-AL,SMD,47uF,20%6.35V	4	C44,63,72,76

NO	SEC CODE	DESCRIPTION	Q'TY	PART LOCATION
85	2402-000170	C-AL,SMD,1uF,20%,50V	7	C19,24,33,58,68,70,78
86	2402-000173	C-AL,SMD,4.7uF,20%,35V	6	C54,61,62,73,77,79
87	2703-000343	INDUCTOR,SMD,220uH,10%	4	L10,11,12,13
88	3301-000345	CORE-FERRITE BEAD	1	L1
89	3704-000275	SOCKET-IC,40P,DIP	1	U1
90	3708-000157	CONNECTOR-FPC/FC/PIC,14P	1	P1
91	3722-000269	JACK-MODULAR,6P/6C	1	P2
92	881-105532AA	IC-LIN,5532,OP-AMP,DIP	1	U4
93	881-802003GA	IC-LIN,2003,DAR-TR ARRY	1	U16
94	897-130505AB	VARISTOR,1.5V,0.3W	1	VR1
95	GC39-50060A	CBF-LINE CORD,HA,2000 mm	1	
96	JF27-30053A	COIL-RF,SF2600,4mH,7.50HM	2	L8,9
97	0903-000178	IC-MICROCONTROLLER,8751	1	U1
98	2011-000582	R-NETWORK,47K,5%,1/8W	1	RA1
99	2401-000355	C-AL,100uF,20%,50V	1	C38
100	2401-001368	C-AL,470uF,20%,16V	1	C40
101	3409-000121	SWITCH-HOOK,53V,100mA	1	H/S1
102	3711-000822	CONNECTOR-HEADERBOX,2P	2	P4,P5
103	3722-000265	JACK-MODULAR,4P/4C	1	P3
104	941-110040AA	CRYSTAL,11.0592M	1	Y1

4.3 6 BUTTON KEYSET(GA92-01171A)

PARTS LIST

NO	SEC CODE	DESCRIPTION	Q'TY	PART LOCATION
1	EC26-20501A	TRANS-AF,5692,800mH	2	T1,T2
2	GA13-10108A	IC-HYB,SI8201	1	U5
3	GA41-10603A	PCB 6LINE	1	
4	0401-000128	DIODE-SWITCHING,HSK-120	16	D1-D15,D17
5	0402-000305	DIODE-RECTIFIER,RLR4003	1	D16
6	0403-000524	DIODE-ZENER,1N4732A,4.7V	1	ZD1
7	0601-000208	LED-CHIP,RED	10	SDL1-SDL6,SKP,HLD,MES,MUT
8	0801-000690	74HC373	3	U13,U14,U15
9	1001-000135	IC-ANALOG SWITCH,CD22000E	1	U7
10	1001-000170	IC-ANALOG SWITCH,MC14051B	2	U9,U11
11	1201-000105	IC-AUDIO AMP,34119,SOP,8P	1	U12
12	1201-000423	IC-OP AMP,4558,SOP,8P	2	U3,U8
13	1202-000161	IC-VOLTAGE COMP,393,SOP	1	U2
14	1203-000161	IC-POSI ADJUST REGULATOR,78L12	1	U6
15	1405-000164	VARISTOR,68V,250A	1	VAR1
16	2007-000285	R-CHIP,100K,5%,1/8W	5	R1,7,8,17,48,130
17	2007-000223	R-CHIP,1.2K,5%,1/8W	1	R68
18	2007-000293	R-CHIP,100,5%,1/8W	4	R108,109,110,111
19	2007-000299	R-CHIP,10K,1%,1/8W	1	R3
20	2007-000303	R-CHIP,10K,5%,1/8W	8	R13,16,29,41,44,100,102,121
21	2007-000312	R-CHIP,10,5%,1/8W	2	R37,101
22	2007-000341	R-CHIP,120K,5%,1/8W	2	R55,56
23	2007-000359	R-CHIP,12K,5%,1/8W	2	R35,46
24	2007-000382	R-CHIP,13K,5%,1/8W	1	R65
25	2007-000412	R-CHIP,15K,5%,1/8W	2	R25,R93,120
26	2007-000451	R-CHIP,180,5%,1/8W	2	R11,12
27	2007-000472	R-CHIP,1K,5%,1/8W	4	R4,22,53,58
28	2007-000521	R-CHIP,2.7K,5%,1/8W	1	R42
29	2007-000548	R-CHIP,20K,5%,1/8W	3	R15,59,119
30	2007-000589	R-CHIP,22K,5%,1/8W	1	R27
31	2007-000617	R-CHIP,24K,5%,1/8W	1	R26
32	2007-000656	R-CHIP,27K,5%,1/8W	3	R45,94,117
33	2007-000674	R-CHIP,2K,5%,1/8W	2	R5,43
34	2007-000688	R-CHIP,3.3K,5%,1/8W	2	R98,103
35	2007-000725	R-CHIP,300K,5%,1/8W	1	R10
36	2007-000740	R-CHIP,30K,5%,1/8W	2	R38,40
37	2007-000806	R-CHIP,36K,5%,1/8W	1	R95
38	2007-000824	R-CHIP,390,5%,1/8W	2	R28,52
39	2007-000260	R-CHIP,1.6K,5%,1/8W	2	R71,90
40	2007-001241	R-CHIP,910,5%,1/8W	1	R131
41	2007-001226	R-CHIP,9.1K,5%,1/8W	1	R92
42	2007-001162	R-CHIP,75K,5%,1/8W	1	R96
43	2007-000341	R-CHIP,120K,5%,1/8W	1	R97

NO	SEC CODE	DESCRIPTION	Q'TY	PART LOCATION
44	2007-000855	R-CHIP,4.32K,1%,1/8W	1	R6
45	2007-000861	R-CHIP,4.3K,5%,1/8W	2	R31,32
46	2007-000875	R-CHIP,4.7K,5%,1/8W	9	R14,18,19,39,50,61,91,104,122
47	2007-000934	R-CHIP,470,5%,1/8W	1	R9
48	2007-000985	R-CHIP,5.6,2%,1/2W	2	R49,51
49	2007-001099	R-CHIP,62K,5%,1/8W	1	R66
50	2007-001144	R-CHIP,7.5K,5%,1/8W	2	R54,57
51	2007-001203	R-CHIP,820,5%,1/8W	2	R2,47
52	2007-001246	R-CHIP,91K,5%,1/8W	1	R99
53	2007-000768	R-CHIP,330,5%,1/8W	1	R24
54	2007-000777	R-CHIP,33K,5%,1/8W	1	R116
55	2007-000944	R-CHIP,47K,5%,1/8W	1	R30
56	2007-000542	R-CHIP,200,5%,1/8W	1	R60
57	2007-000914	R-CHIP,43K,5%,1/8W	1	R114
58	2007-000705	R-CHIP,3.6K,5%,1/8W	1	R20
59	2007-001197	R-CHIP,820K,5%,1/8W	1	R132
60	2007-001027	R-CHIP,560K,5%,1/8W	1	R69
61	2007-000464	R-CHIP,18,5%,1/8W	1	R105
62	911-710007CR	REF-CHIP,0,5%,1/8W	9	R23,33,124,126,128,L2-5
63	2203-000789	C-CERAMIC,CHIP,330pF,20%	2	C88,89
64	2203-000262	C-CERAMIC,CHIP,10nF,10%	4	C46,47,53,57
65	2203-000557	C-CERAMIC,CHIP,20pF,5%	2	C22,23
66	2203-000717	C-CERAMIC,CHIP,3.3nF,10%	1	C35
67	2203-000805	C-CERAMIC,CHIP,33nF,10%	1	C85
68	2203-000841	C-CERAMIC,CHIP,390pF,5%	2	C48,C50
69	2203-000955	C-CERAMIC,CHIP,470pF,5%	4	C25,52,87,90
70	2203-001145	C-CERAMIC,CHIP,68nF,10%	1	C31
71	2203-001450	C-CERAMIC,CHIP,100nF,10%	13	C1,2,7,9,11,13,14,15,16,17 C18,20,21
72	2203-001452	C-CERAMIC,CHIP,100nF,20%	9	C28,30,36,39,42,45,55,56,80
73	2305-000587	C-FILM,MOEF,470nF,10%,63V	2	C81,82
74	2401-000282	C-AL,100uF,20%,16V	3	C32,37,51
75	2401-000802	C-AL,220uF,20%,16V	5	C3,4,8,12,86
76	2402-000120	C-AL,SMD,10uF,20%,50V	1	C41
77	2402-000130	C-AL,SMD,2.2uF,20%,50V	2	C29,43
78	2402-000165	C-AL,SMD,47uF,20%,6.35V	3	C44,76
79	2402-000170	C-AL,SMD,1uF,20%,50V	4	C19,24,33,78
80	2402-000173	C-AL,SMD,4.7uF,20%,35V	3	C54,77,79
81	2703-000343	INDUCTOR,SMD,220uH,10%	4	L10,11,12,13
82	3301-000345	CORE-FERRITE BEAD	1	L1
83	3704-000275	SOCKET-IC,40P,DIP	1	U1
84	3722-000269	JACK-MODULAR,6P/6C	1	P2
85	881-105532AA	IC-LIN,5532,OP-AMP,DIP	1	U4

NO	SEC CODE	DESCRIPTION	Q'TY	PART LOCATION
86	881-802003GA	IC-LIN,2003,DAR-TR ARRY	1	U16
87	897-130505AB	VARISTOR,1.5V,0.3W	1	VR1
88	GC39-50060A	CBF-LINE CORD,HA,2000 mm		
89	JF27-30053A	COIL-RF,SF2600,4mH,7.50HM	2	L8,9
90	0903-000178	IC-MICROCONTROLLER,8751	1	U1
91	2011-000582	R-NETWORK,47K,5%,1/8W	1	RA1
92	2401-000355	C-AL,100uF,20%,50V	1	C38
93	2401-001368	C-AL,470uF,20%,16V	1	C40
94	3409-000121	SWITCH-HOOK,53V,100mA	1	H/S1
95	3711-000822	CONNECTOR-HEADERBOX,2P	1	P5
96	3722-000265	JACK-MODULAR,4P/4C	1	P3
97	941-110040AA	CRYSTAL,11.0592M	1	Y1

4.4 DSS BOX(Add-On-Module)(GA92-01173A)

PARTS LIST

NO	SEC CODE	DESCRIPTION	Q'TY	PART LOCATION
1	EC26-20501A	TRANS-AF,5692,800mH	2	T1,T2
2	GA13-10108A	IC-HYB,SI8201	1	U8
3	GA41-10604A	PCB AOM	1	
4	0401-000128	DIODE-SWITCHING,HSK-120	14	D1-D14
5	0402-000305	DIODE-RECTIFIER,1N4004	1	D16
6	0601-000208	LED-CHIP,RED	24	SDL1-SDL24
7	0801-000690	74HC373	3	U4,U5,U6
8	1202-000161	IC-VOLTAGE COMP,393,SOP	1	U2
9	1203-000161	IC-POSI ADJUST REGULATOR	1	U9
10	1405-000164	VARISTOR,68V,250A	1	VAR1
11	2007-000285	R-CHIP,100K,5%,1/8W	5	R1,7,8,17,27
12	2007-000293	R-CHIP,100,5%,1/8W	4	R35,36,37,38
13	2007-000299	R-CHIP,10K,1%,1/8W	1	R3
14	2007-000303	R-CHIP,10K,5%,1/8W	2	R23,30
15	2007-000312	R-CHIP,10,5%,1/8W	1	R20
16	2007-000359	R-CHIP,12K,5%,1/8W	1	R31
17	2007-000451	R-CHIP,180,5%,1/8W	2	R18,19
18	2007-000472	R-CHIP,1K,5%,1/8W	1	R4
19	2007-000521	R-CHIP,2.7K,5%,1/8W	1	R28
20	2007-000656	R-CHIP,27K,5%,1/8W	1	R29
21	2007-000674	R-CHIP,2K,5%,1/8W	2	R5,26
22	2007-000725	R-CHIP,300K,5%,1/8W	1	R10
23	2007-000740	R-CHIP,30K,5%,1/8W	2	R21,22
24	2007-000855	R-CHIP,4.32K,1%,1/8W	1	R6
25	2007-000875	R-CHIP,4.7K,5%,1/8W	3	R24,39,40
26	2007-000934	R-CHIP,470,5%,1/8W	1	R9
27	2007-000985	R-CHIP,5.6,2%,1/2W	2	R32,33
28	2007-001203	R-CHIP,820,5%,1/8W	2	R2,25
29	2007-000464	R-CHIP,18,5%,1/8W	1	R34
30	911-710007CR	R-CHIP,0,5%,1/8W	4	L2,3,4,5
31	2203-000789	C-CERAMIC,CHIP,330pF,20%	16	C30-45
32	2203-000557	C-CERAMIC,CHIP,20pF,5%	2	C15,16
33	2203-001450	C-CERAMIC,CHIP,100nF,10%	12	C1,2,4,5,6,7,11,12,14,17 C20,23
34	2305-000587	C-FILM,MOEF,470nF,10%,63V	2	C81,82
35	2401-000282	C-AL,100uF,20%,16V	1	C18
36	2401-000802	C-AL,220uF,20%,16V	2	C3,86
37	2402-000120	C-AL,SMD,10uF,20%,50V	1	C22
38	2402-000130	C-AL,SMD,2.2uF,20%,50V	2	C24,25
39	2402-000170	C-AL,SMD,1uF,20%,50V	1	C13
40	3301-000345	CORE-FERRITE BEAD	1	L1
41	3704-000275	SOCKET-IC,40P,DIP	1	U1
42	3722-000260	JACK-MODULAR,6P/6C	1	P2
43	881-105532AA	IC-LIN,5532,OP-AMP,DIP	1	U3

NO	SEC CODE	DESCRIPTION	Q'TY	PART LOCATION
44	881-802003GA	IC-LIN,2003,DAR-TR ARRY	1	U7
45	GC39-50060A	CBF-LINE CORD,HA,2000 mm		
46	JF27-30053A	COIL-RF,SF2600,4mH,7.50HM	2	L8,9
47	0903-000178	IC-MICROCONTROLLER,8751	1	U1
48	2011-000582	R-NETWORK,47K,5%,1/8W	1	RA1
49	2401-000355	C-AL,100uF,20%,50V	1	C19
50	2401-001368	C-AL,470uF,20%,16V	1	C21
51	941-110040AA	CRYSTAL,11.0592M	1	Y1

4. PBA LAYOUT

4.1 24 BUTTON KEYSET(GA92-01163A)

4.1.1 COMPONENT SIDE.....1

4.1.2 SOLDER SIDE.....2

4.2 12 BUTTON KEYSET(GA92-01167A)

4.2.1 COMPONENT SIDE.....3

4.2.2 SOLDER SIDE.....4

4.3 6 BUTTON KEYSET(GA92-01171A)

4.3.1 COMPONENT SIDE.....5

4.3.2 SOLDER SIDE.....6

4.4 DSS BOX(Add-On-Module)(GA92-01173A)

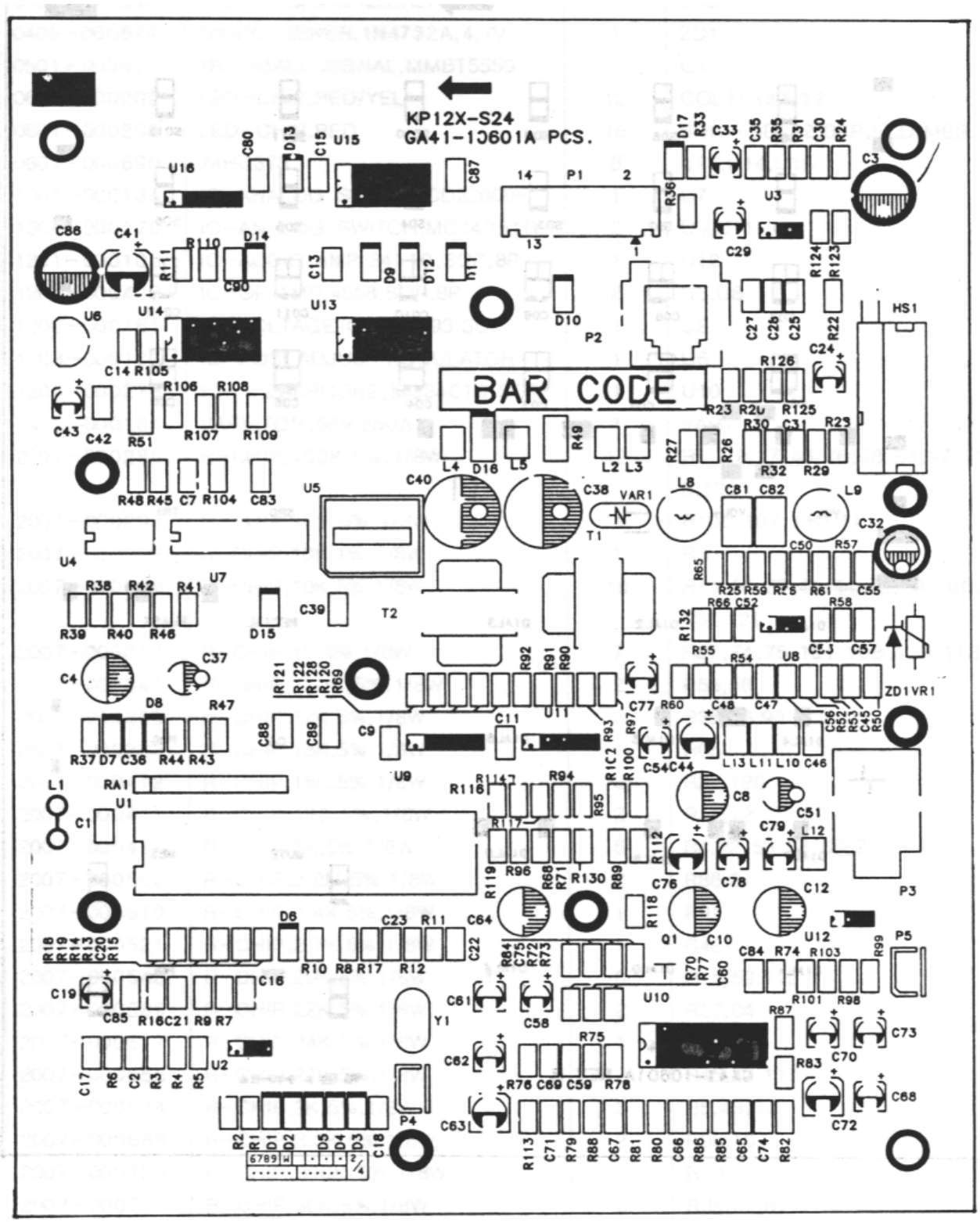
4.4.1 COMPONENT SIDE.....7

4.4.2 SOLDER SIDE.....8

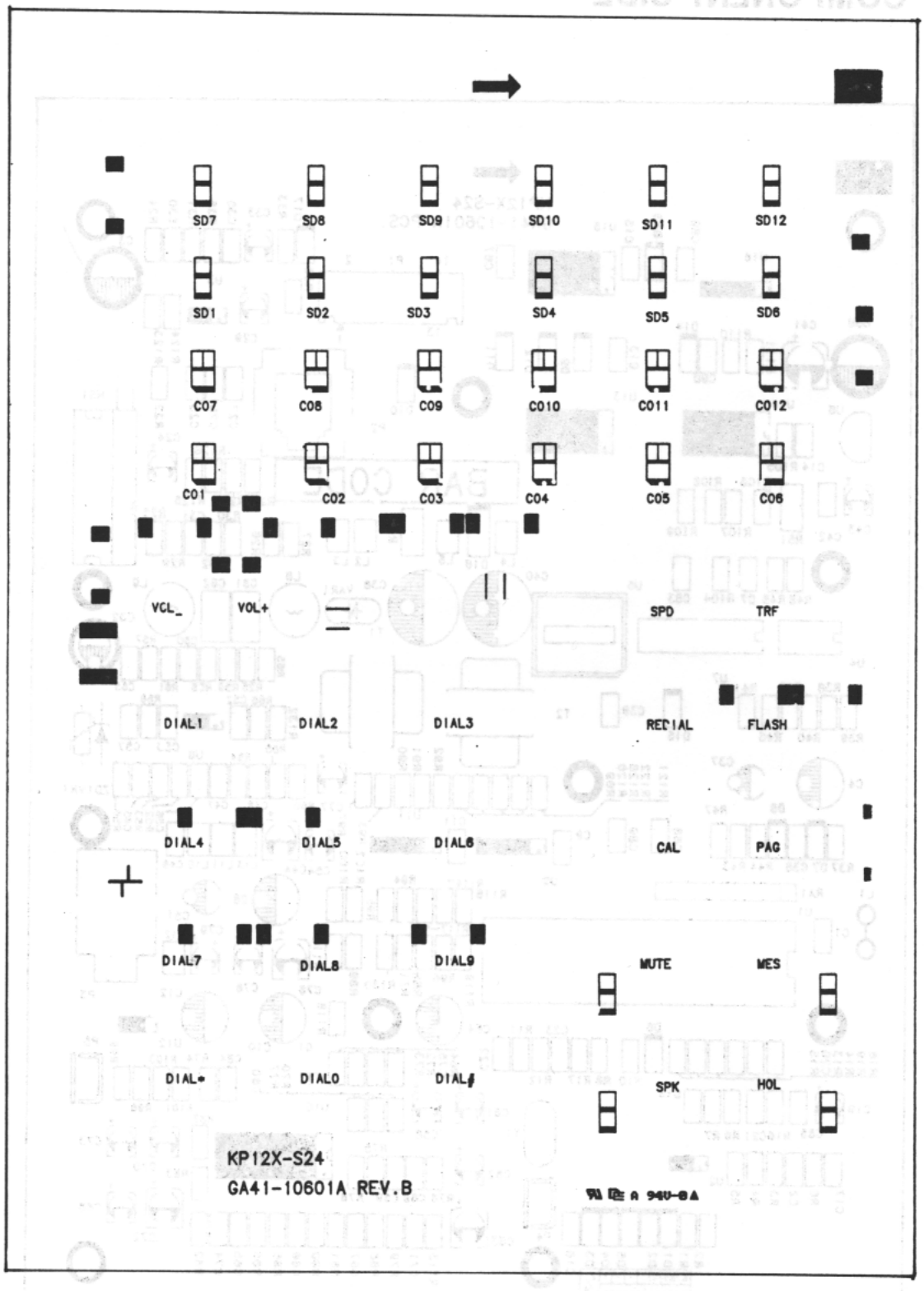
4. PBA LAYOUT AND PARTS LIST

4.1 24 BUTTON KEYSET(GA92-01163A)

4.1.1 COMPONENT SIDE

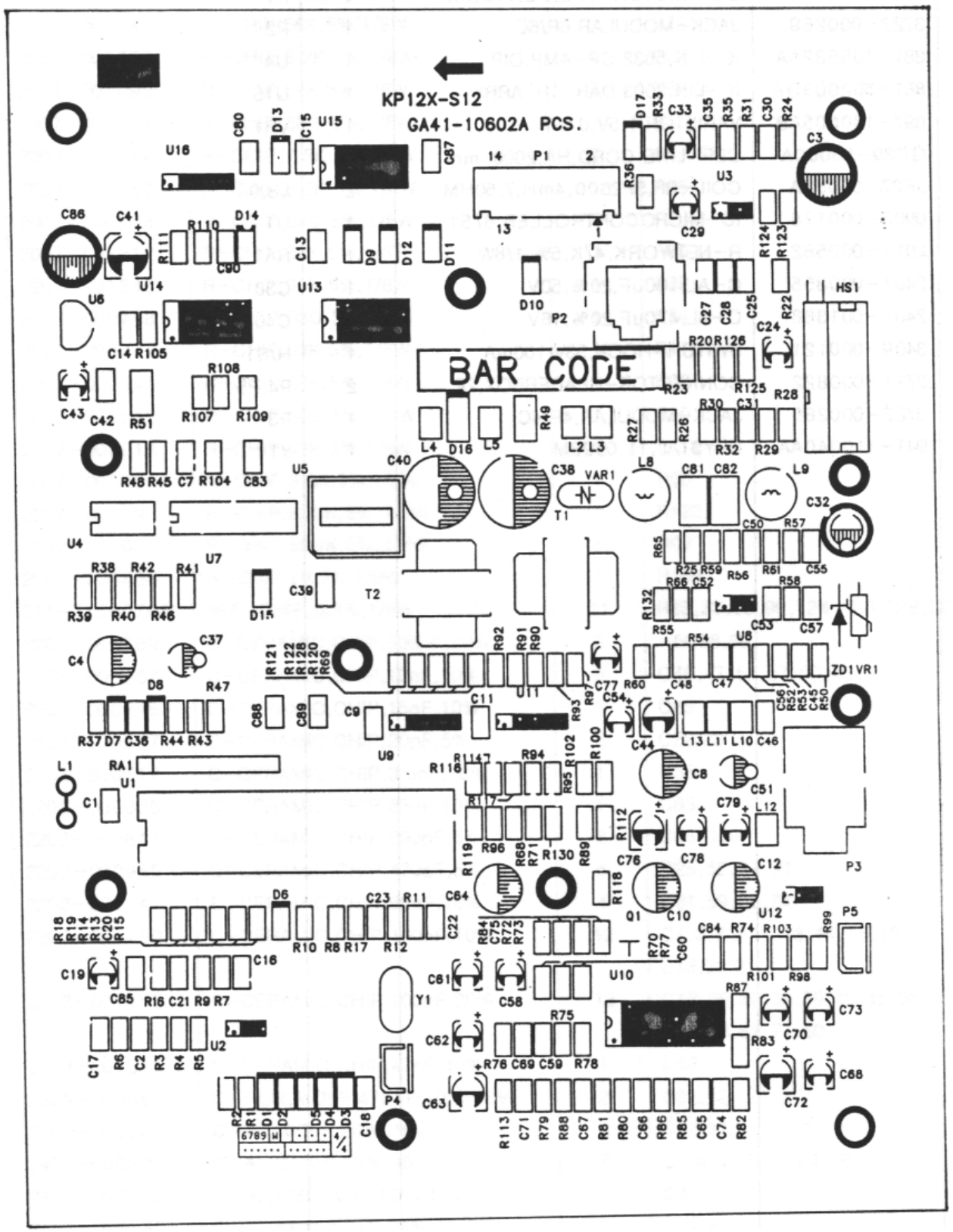


4.1.2 SOLDER SIDE



4.2 12 BUTTON KEYSET(GA92-01167A)

4.2.1 COMPONENT SIDE



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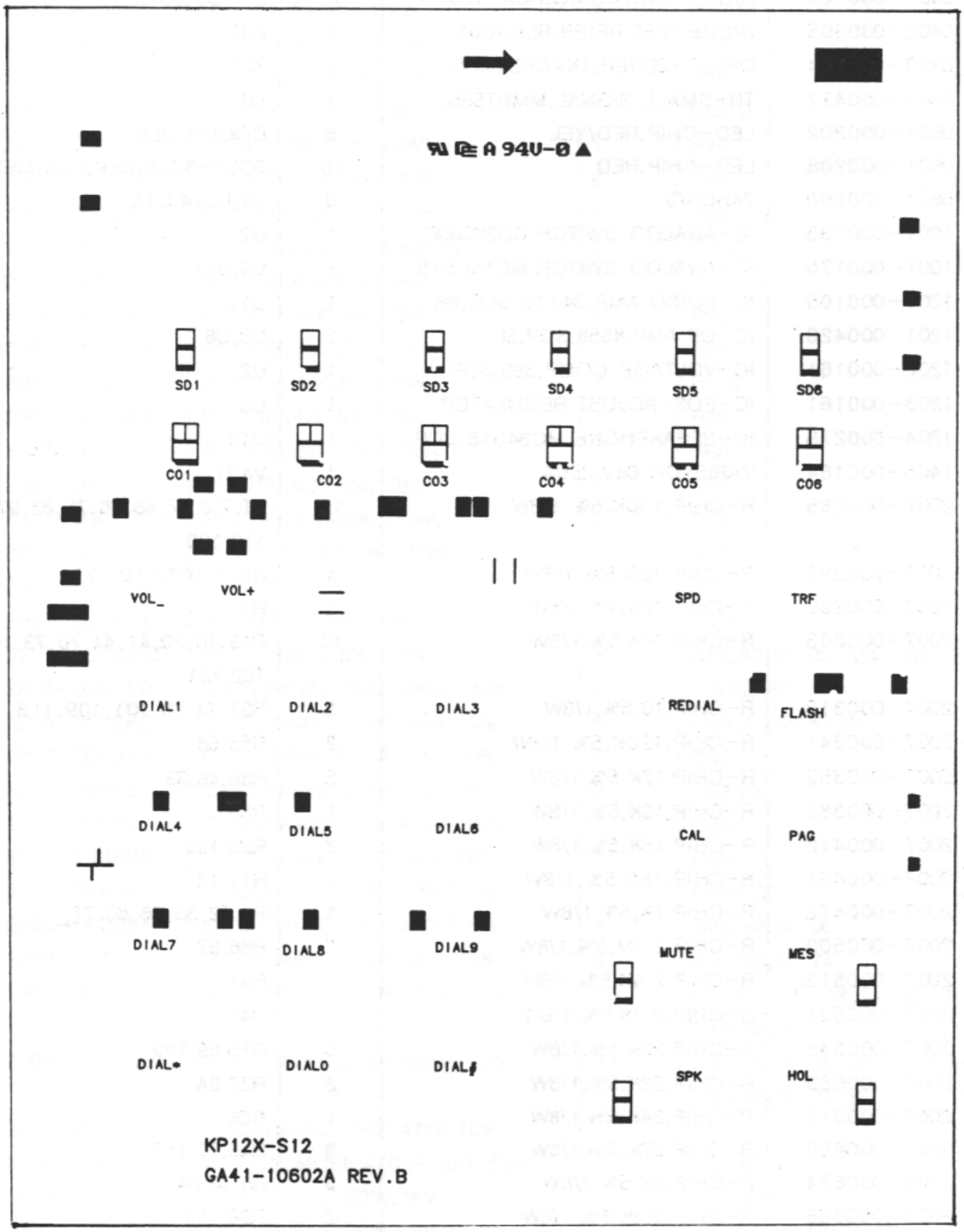
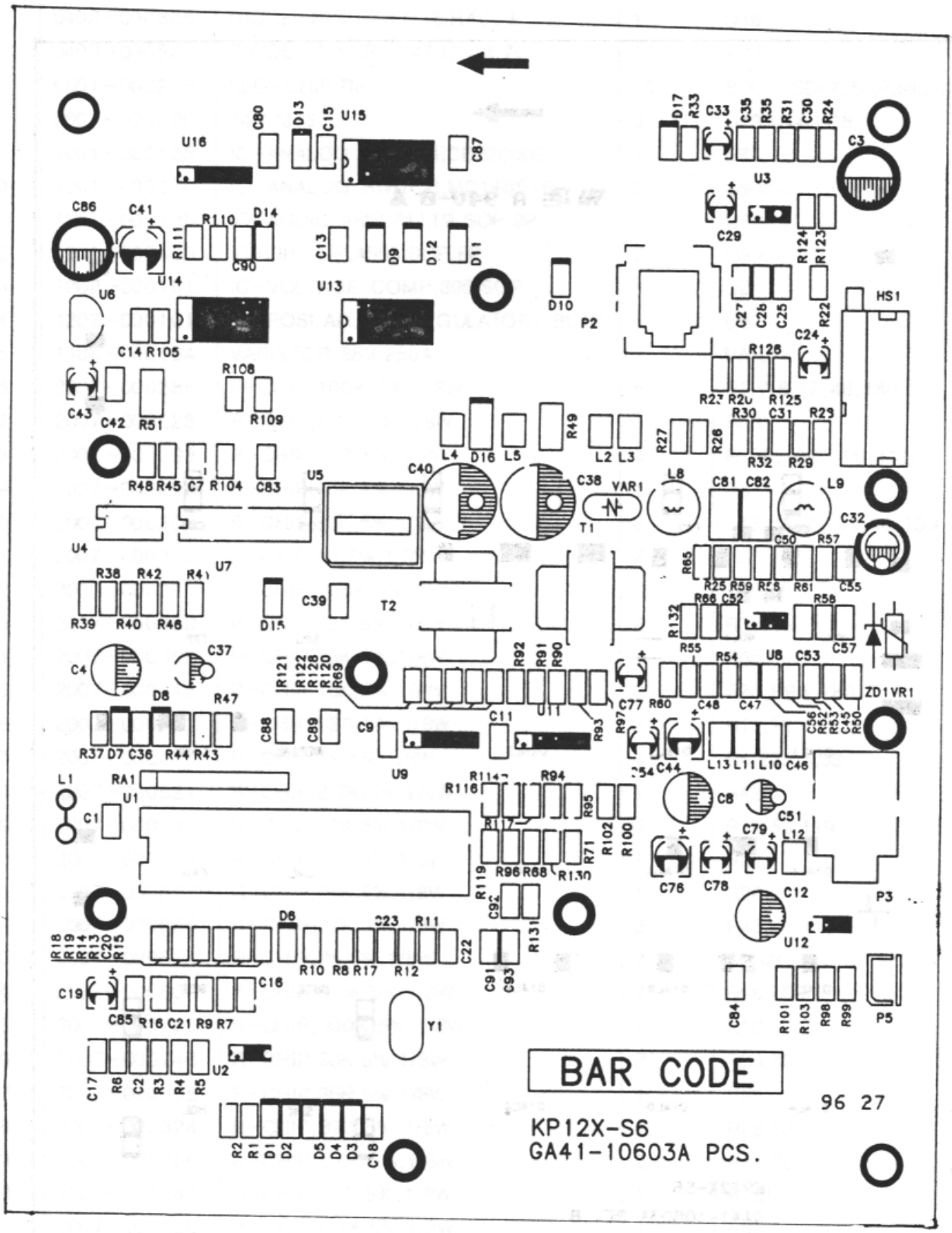


4.3 6 BUTTON KEYSET(GA92-01171A)

4.3.1 COMPONENT SIDE



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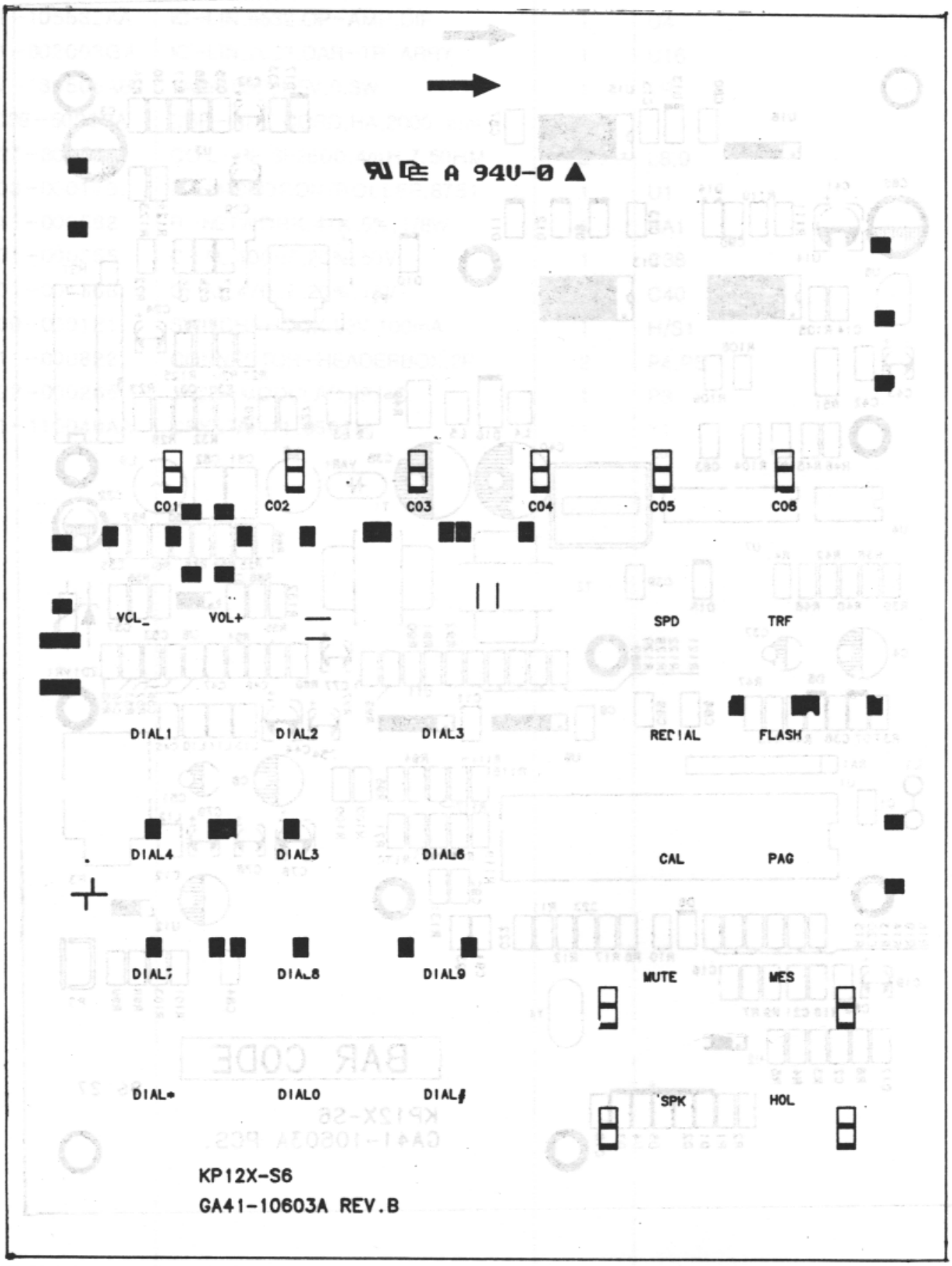
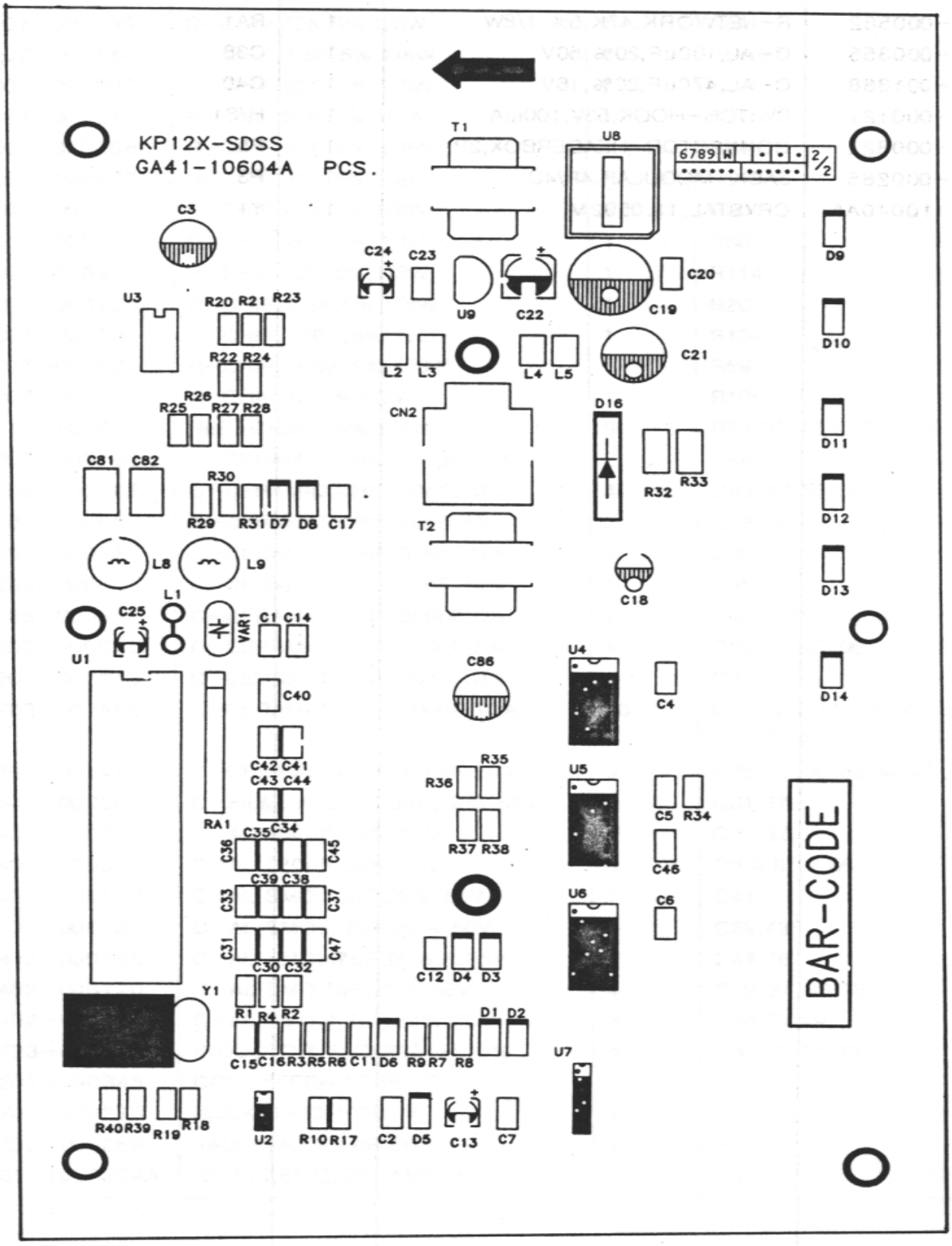
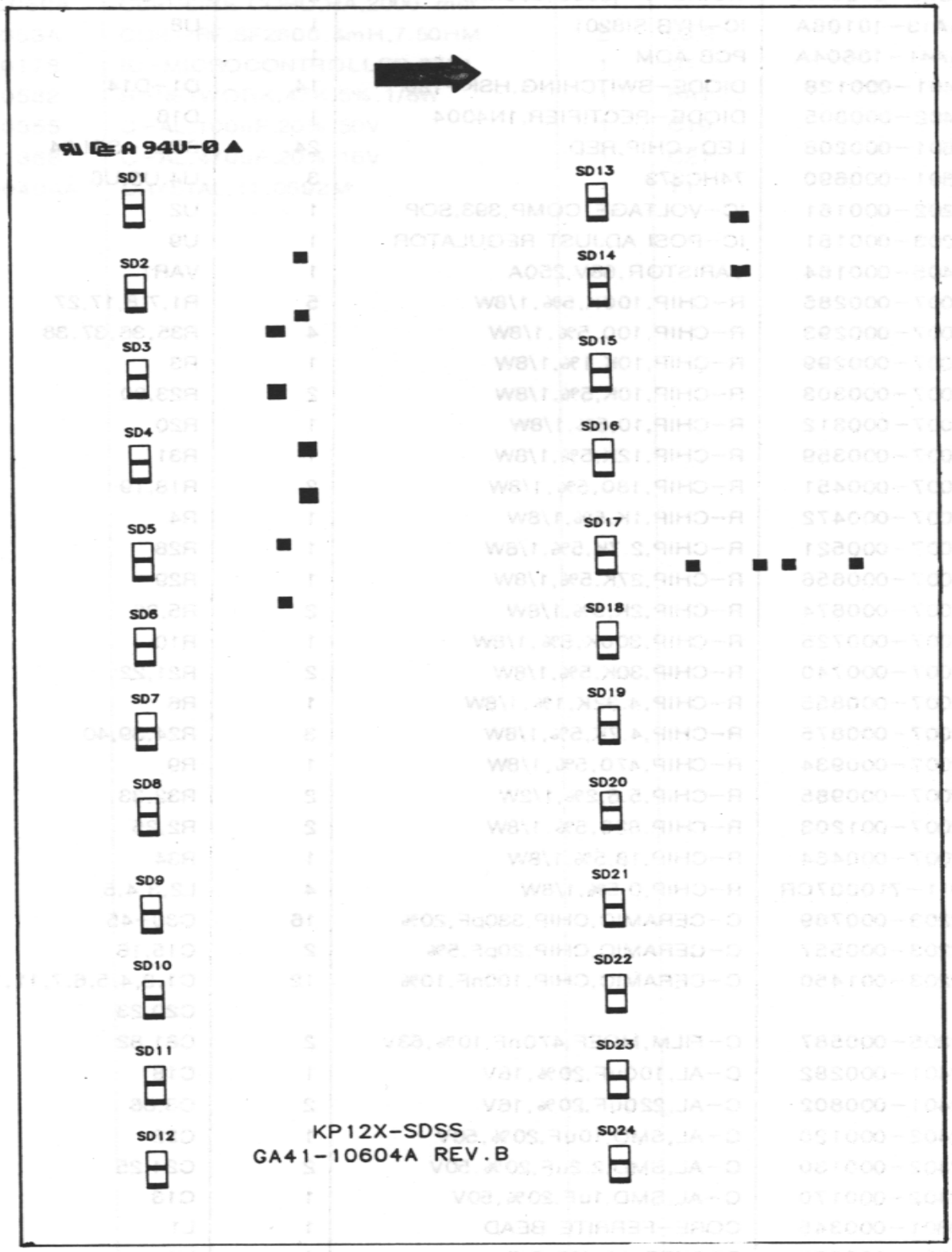


4.4 DSS BOX(Add-On-Module)(GA92-01173A)

4.4.1 COMPONENT SIDE



4.4.2 SOLDER SIDE



6. CIRCUIT DIAGRAM

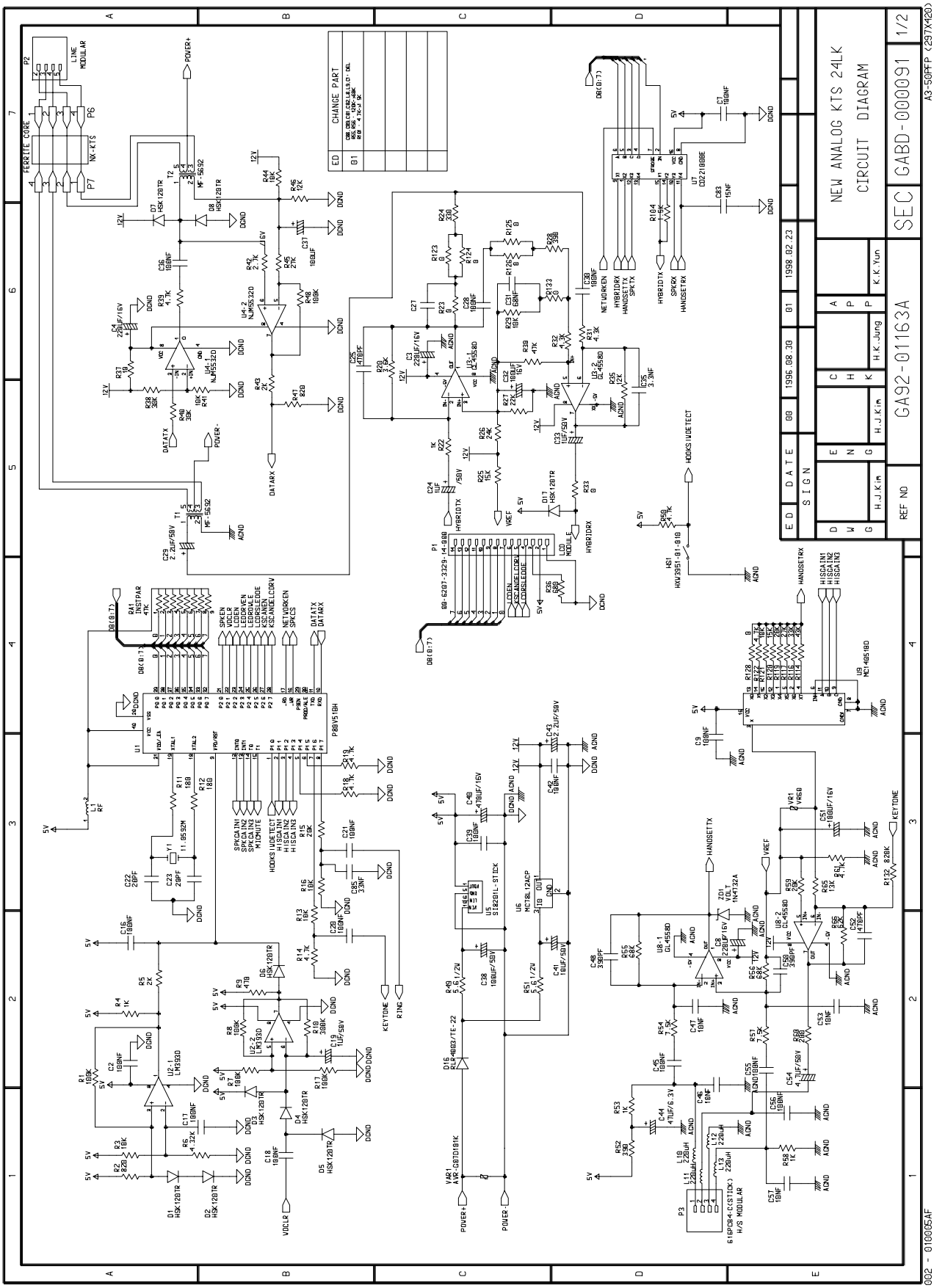
6.1 NX-24L KEYSET

6.2 NX-12L KEYSET

6.3 NX-6L KEYSET

6.4 NX-KEYSET AOM

6.1 NX-24L KEYSET



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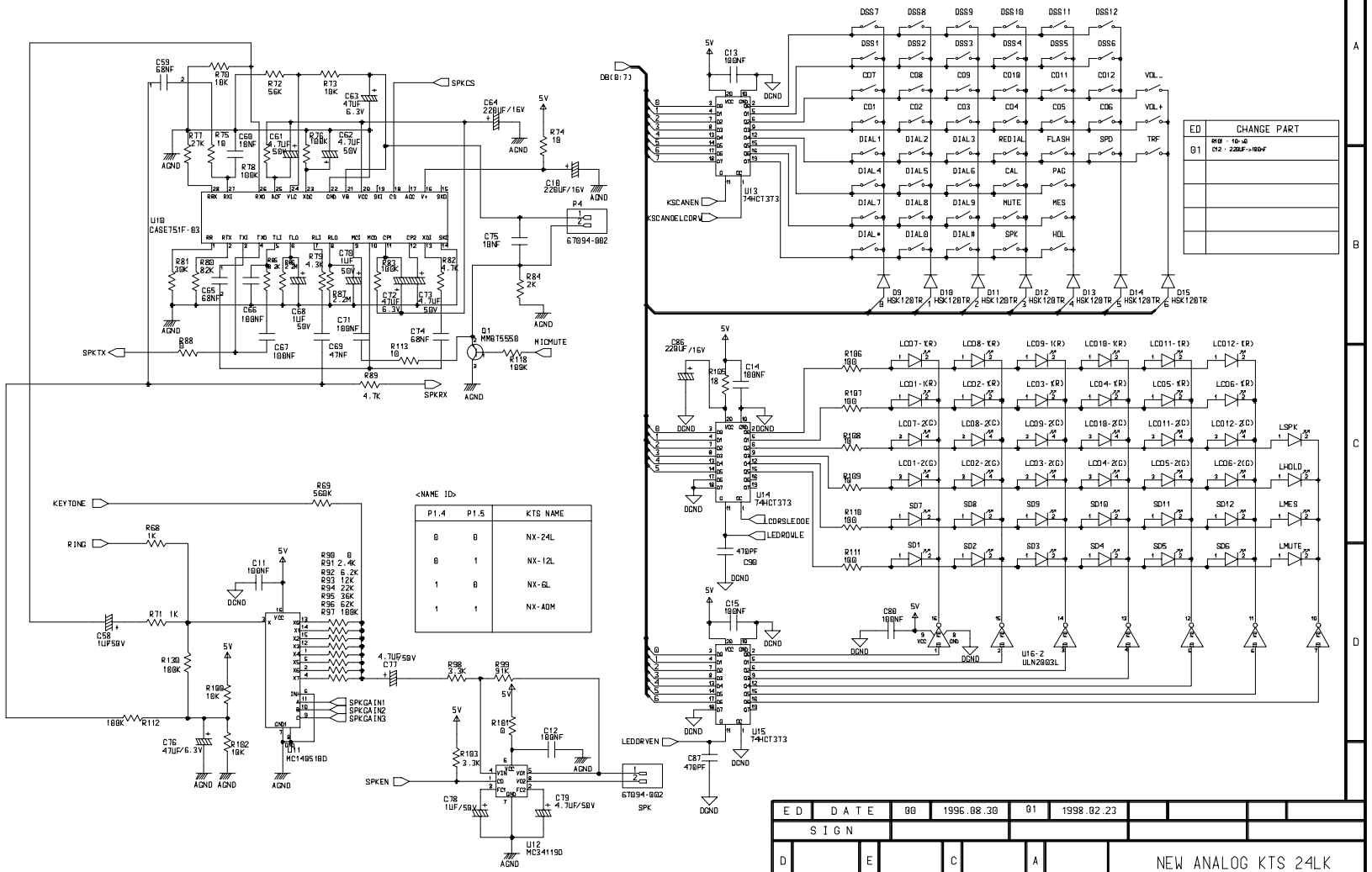


ED	CHANGE PART
01	R68 : 1K->0 C42 : 220UF->100NF

<NAME ID>

P1.4	P1.5	KTS NAME
0	0	NX-24L
0	1	NX-12L
1	0	NX-6L
1	1	NX-ADM

ED	DATE	00	1996.08.30	01	1998.02.23				
	SIGN								

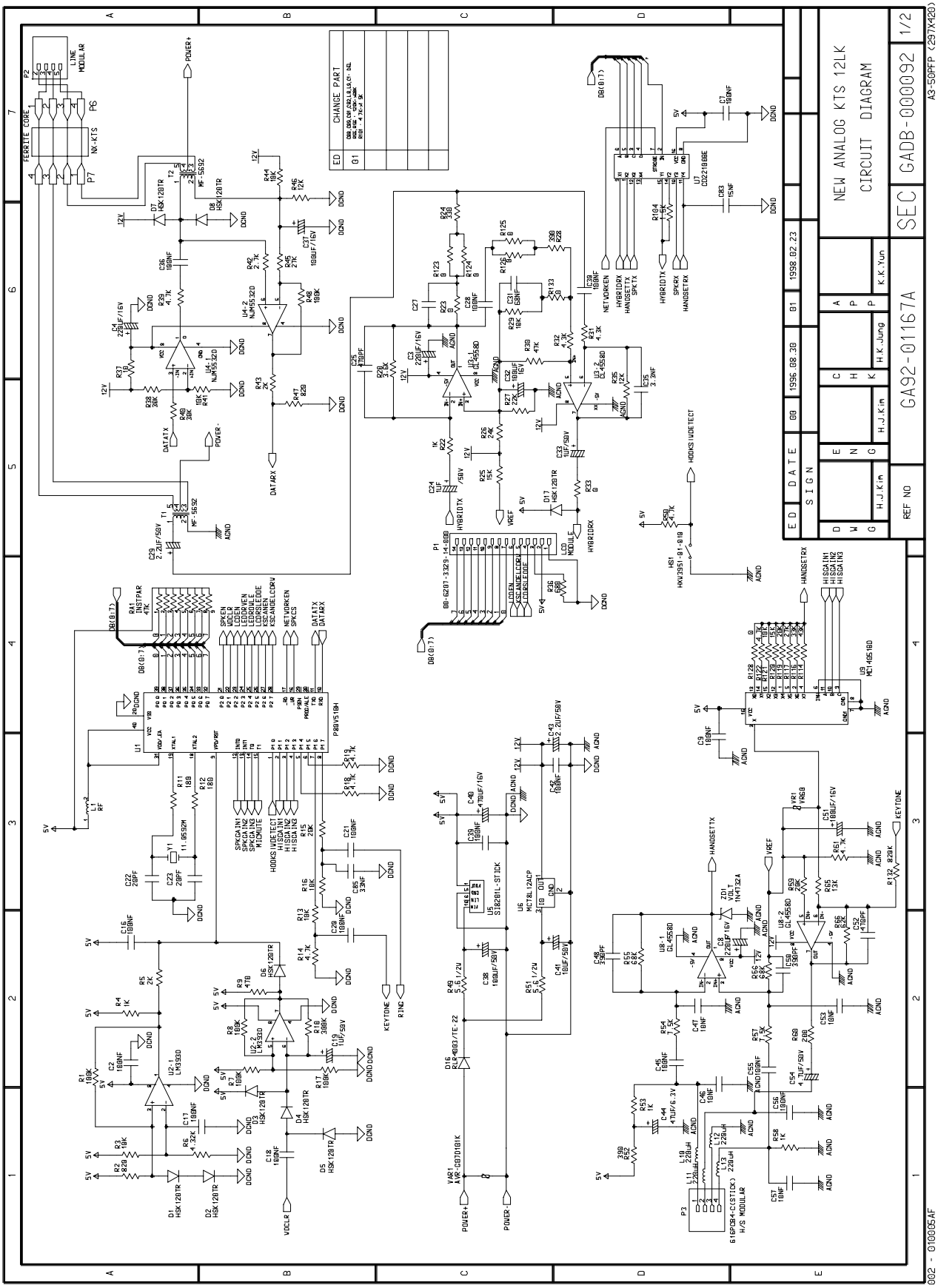
DWG	ENG	CHK	APP	NEW ANALOG KTS 24LK CIRCUIT DIAGRAM
	H.J.Kim	H.J.Kim	H.K.Jung	K.K.Yun

REF NO	GA92-01163A	SEC	GADB-000091	2/2

002 - 010005AF

A3-50PFP (297X420)

6.2 NX-12L KEYSET



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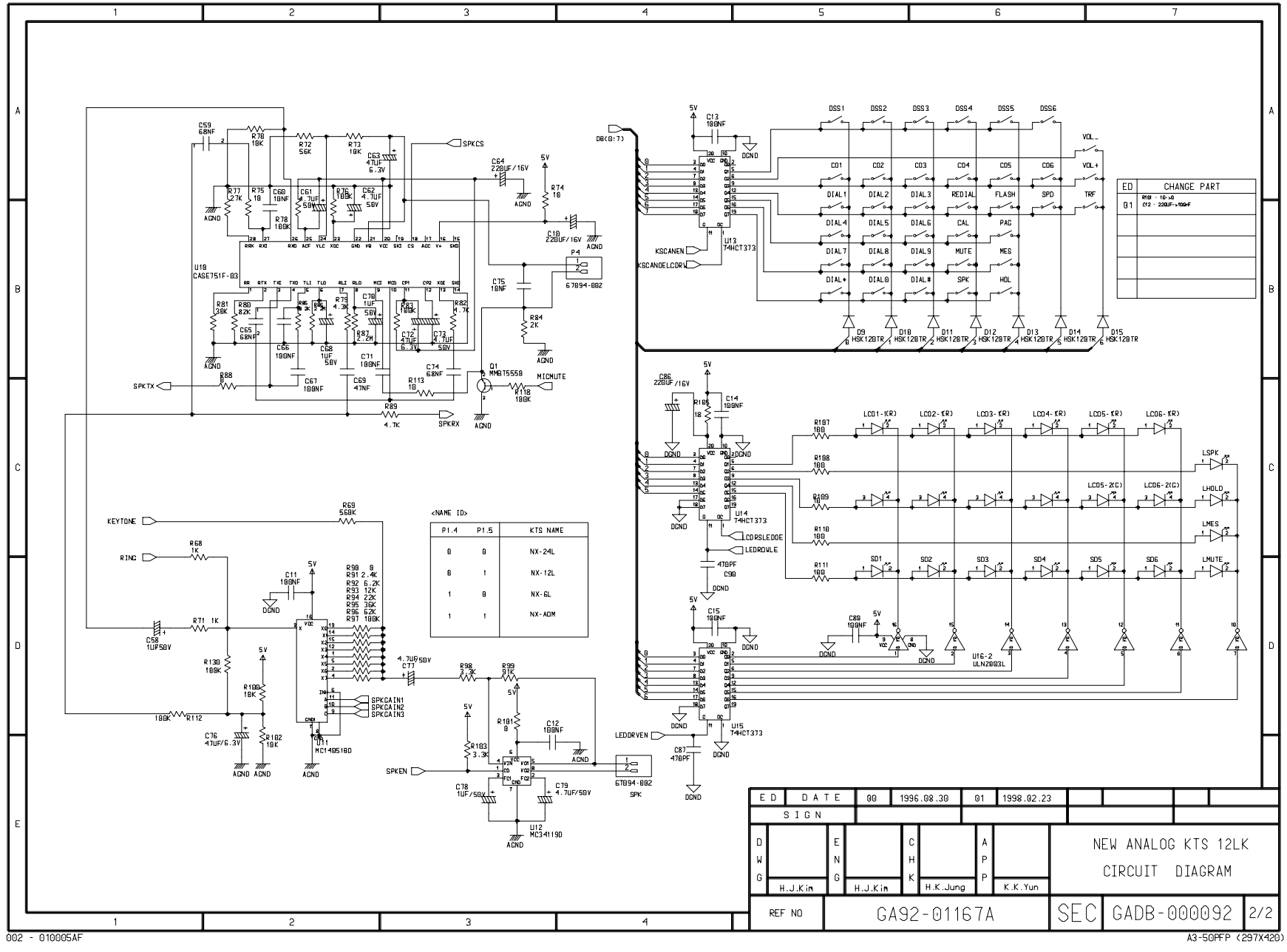

<NAME ID>		
P1.4	P1.5	KTS NAME
0	0	NX-24L
0	1	NX-12L
1	0	NX-6L
1	1	NX-ADM

ED	CHANGE PART
01	R101 ~ 118->0 C12 : 220UF->100NF

ED	DATE	00	1996.08.30	01	1998.02.23				
	SIGN								

DWG	ENG	CHK	APP	NEW ANALOG KTS 12LK CIRCUIT DIAGRAM
	H.J.Kim	H.J.Kim	H.K.Jung	K.K.Yun	

REF NO	GA92-01167A	SEC	GADB-000092	2/2

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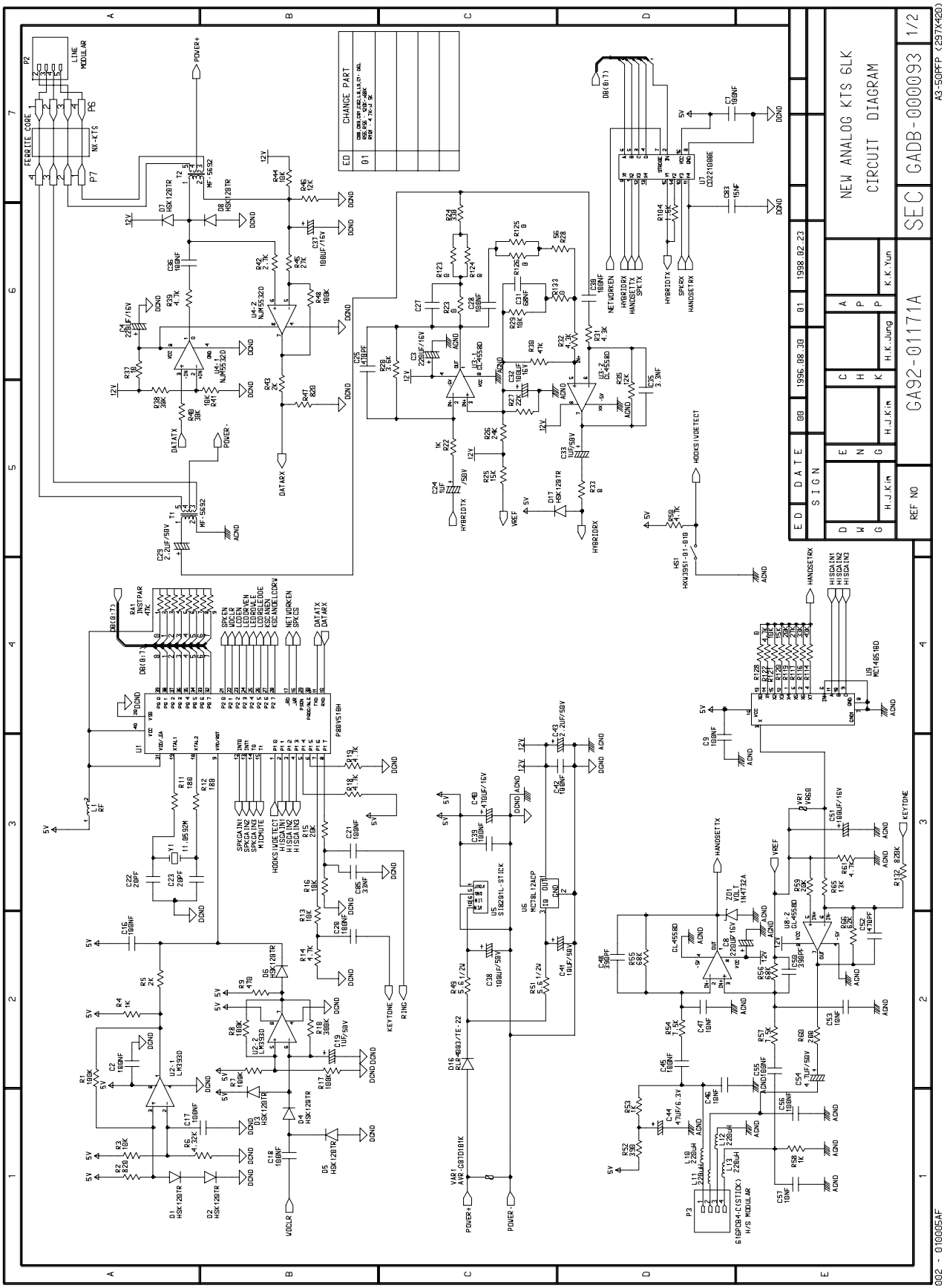
6.3 NX-6L KEYSET



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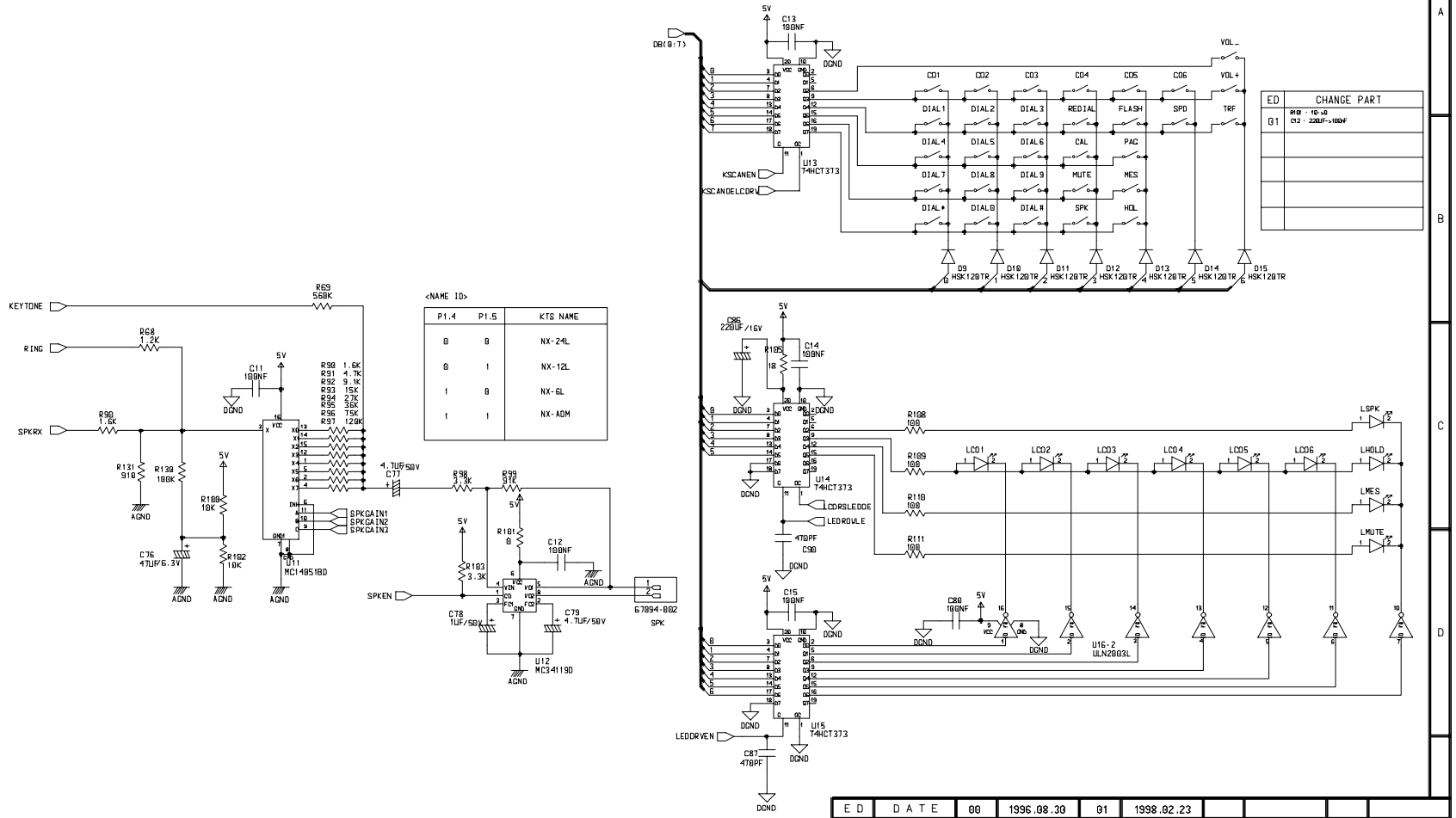


ED	DATE	00	1996.08.30	01	1998.02.23				
	SIGN								

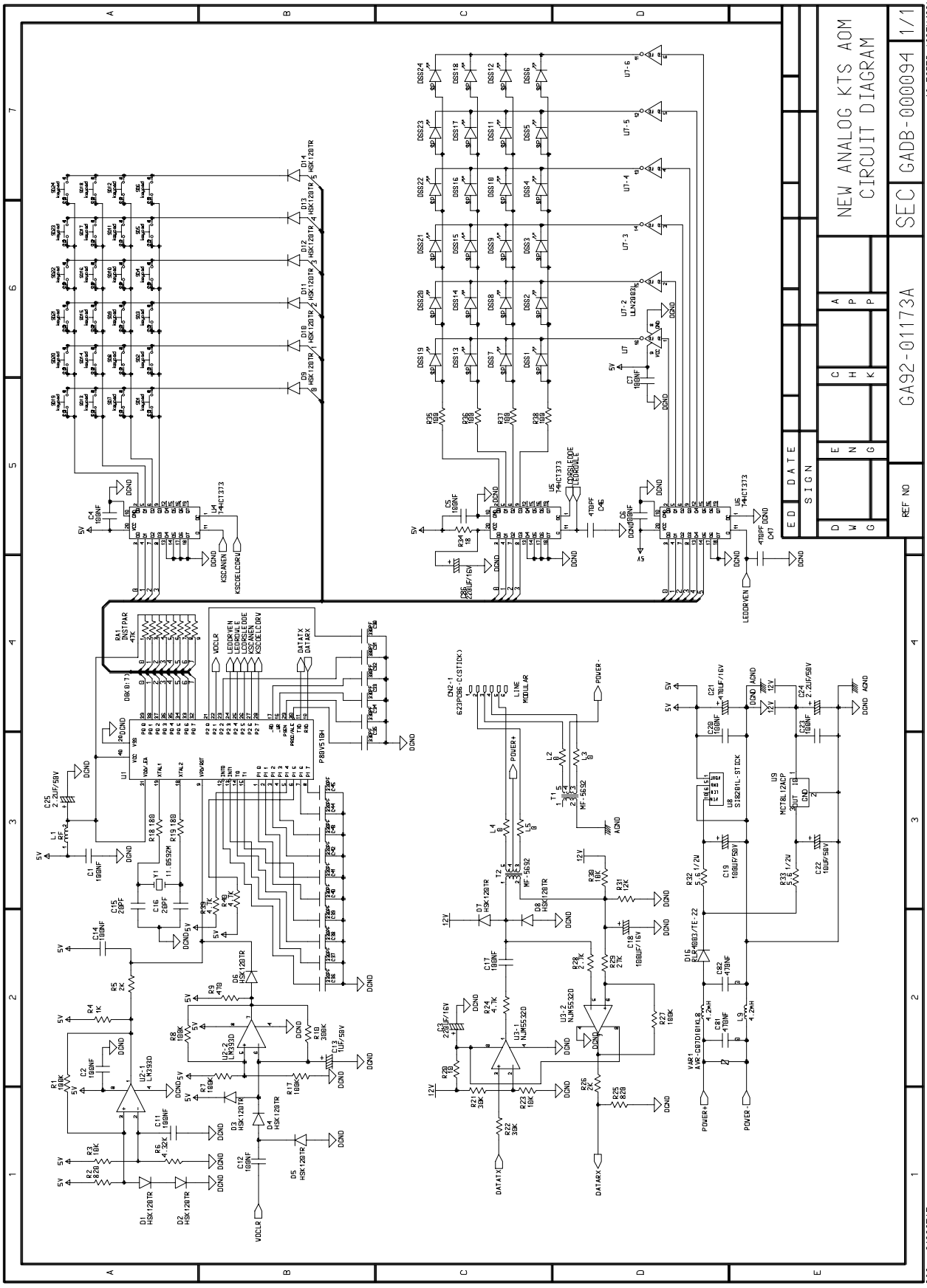
DWG	ENG	CHK	APP	NEW ANALOG KTS 6LK CIRCUIT DIAGRAM
H.J.Kim	H.J.Kim	H.K.Jung	K.K.Yun	

REF NO	GA92-01171A	SEC	GADB-000093	2/2

002 - 010005AF

A3-50PFP (297X420)

6.4 NX-KEYSET AOM



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